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6

THE MARINE RED ALGAE IN THE VICINITY OF THE BIOLOGICAL STATION AT FRIDAY HARBOR, WASH.

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BY

HARALD KYLIN

WITH 47 FIGURES IN THE TEXT

1925

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C. W. K. GLEERUP

LEIPZIG
OTTO HARRASSOWITZ

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Read in the Royal Physiographical Society, April 8th 1925

LUND 1925
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In the year of 1922 I had the opportunity to visit the Biological Station at Friday Harbor, Wash., for ten days at the end of July (17th to 27th). Two years later I came back, and this time from June 14th to July 28th in order to teach marine algae in the summer courses arranged by the University of Washington. I tried to preserve as much algae material as possible and I was fortunate enough in being able to bring back to Sweden a good collection of marine algae from the vicinity of Friday Harbor. During the last winter I have examined the red algae (except the Corallinaceae) in my collection, and the following paper gives an account of the results thus obtained. In this account I have tried to include all the marine red algae (except the Corallinaceae) in the literature said to occur in the region of Puget Sound. I myself did not get specimens of them all. In the following report are enumerated 128 species of marine red algae, whereof my collection contains 103 species with specimens of my own; of 25 species I did not get any specimens.

In the following account I have described no less than 31 species as new ones. Of these, however, 10 species are previously mentioned from the region in question, but not correctly named. 16 species, earlier described from other districts, are in this paper for the first time mentioned as occurring in the vicinity of Friday Harbor. — Three new genera are described, viz. *Thuretellopsis*, *Opuntiella* and *Pugetia*.

The species can be grouped together as follows.

Species neither collected nor seen by me from the region of Puget Sound; 15 species.

Porphyra abysicola
Whidbeyella cartilaginea
Gelidium Amansii
Gloiosiphonia verticillaris
» californica
Petrocoelis Middendorffii
Rhodoglossum latissimum
Ahnfeltia plicata
Ahnfeltia concinna
Callophyllis Thompsonii
» crenulata
Callymenia oblongifructa
Rhodochorton subimmersum
Pterosiphonia Woodii
Janczewskia Gardneri.

Species not collected by myself, but seen in different collections from the region of Puget Sound; *Aeodes Gardneri* nov. sp.; 10 species.

Bangia fuscopurpurea
Porphyra miniata f. cuneiformis
» variegata
Aeodes Gardneri
Grateloupia Cutleriae
Grateloupia pinnata
Chylocladia ovalis f. subarticulata
Polysiphonia senticulosa
Pterosiphonia arctica
Lophosiphonia obscura.

Species collected by myself, previously known from the region of Puget Sound; 57 species.

Porphyra perforata
» nereocystis
» naiadum
» amplissima
Asparagopsis hamifera
Cryptosiphonia Woodii
Farlowia mollis
Weeksia Fryeana
Constantinea subulifera
Gloiopeltis furcata
Prionitis Lyallii
Opuntiella californica
Hildenbrandtia rosea
Endocladia muricata
Iridaea cordata
» heterocarpa
Gigartina papillata
» exasperata
Stenogramma californica
Callophyllis flabellulata
» heanophylla
Agardhiella Coulteri
Anatheca furcata
Euthora fruticulosa
Gracillaria confervoides
Fauchea Fryeana
Rhodymenia Gardneri
» pertusa
» palmata
Halosaccion glandiforme
Antithamnion pacificum
» subulatum
Platythamnion reversum
Callithamnion Pikeanum
Pleonosporium vancouverianum
Ceramium pacificum
» californicum
Microcladia borealis
» Coulteri
Membranoptera platyphylla
» tenuis
Delesseria decipiens
Polyneura latissima
Heteronema boreale
Hymenena Fryeana
» flabelligera
Cryptopleura Ruprechtiana
Dasyopsis plumosa
Polysiphonia urceolata
» tenuistriata
Pterosiphonia bipinnata
» dendroidea
Rhodomela larix
Odonthalia floccosa
» kamtschatica
» Lyallii
Laurencia spectabilis.

Species collected by myself, previously known from the region of Puget Sound, but not correctly named, here described as new ones; 9 species.

Cryptonemia borealis
Turnerella pacifica
Plocamium pacificum
Antithamnion occidentale

Platythamnion villosum
Griffithsia pacifica
Ptilota tenuis
Herposiphonia grandis
Odonthalia washingtoniensis.

Species collected by myself, previously not mentioned from the region of Puget Sound; 16 species.

Goniotrichum elegans
» cornu cervi
Erythrotrichia Bertholdii
Erythrocladia irregularis
» subintegra
Porphyropsis coccinea
Gloiophloea confusa
Gelidium cartilagineum
Petrocelis franciscana
Hildenbrandtia occidentalis
Chrysymenia pseudodichotoma
Trailliella intricata
Rhodochorton penicilliforme
» membranaceum
Antithamnion floccosum
Gonimophyllum Skottsbergii.

Species collected by myself, here described as new ones; 21 species.

Acrochaetium Desmarestiae
» pacificum
Thuretellopsis Peggiana
Peyssonnelia pacifica
Pugetia fragilissima
Callophyllis edentata
Callocolax fungiformis
Rhodymenia stipitata
Plocamium tenue
Rhodochorton tenue
Antithamnion defectum
Antithamnion glanduliferum
Platythamnion pectinatum
Callithamnion biseriatum
» acutum
Pleonosporium squarrosum
Ceramium washingtoniense
Nitophyllum mirabile
Heterosiphonia densissima
» laxa
Pterosiphonia gracilis.

Lund, Botanical Laboratory, April 1925.

Bangiales.

Fam. Bangiaceae.

Goniotrichum Kütz. (1843).

1) Plant 2—3 mm high, branched; cells usually in a single row, rarely two or three at the same level; filaments 12—30 μ thick. ..... *G. elegans.*
2) Plant 2—3 mm high, branched; cells irregularly arranged, in the broader parts 5—8 cells in the cross section, in the young parts a single row of cells; older filaments 30—60 μ thick. ..... *G. cornu cervi.*

Goniotrichum elegans (Chauv.) Le Jolis Alg. mar. Cherb. p. 103; Hauck Meeresalgen p. 518; Rosenv. Mar. Alg. Denm. p. 75; *Bangia elegans* Chauvin (1838) in Mém. Soc. Linn. Norm. Vol. 6 p. 13 (not seen); Harv. Phyc. Brit. pl. 246. — Type specimens from the west coast of France (Normandie).

Brown Island, Shaw Island, Canoe Island, Peavine Pass; growing on different red algae or on *Sertularia* at a depth of 5—10 fathoms.

Goniotrichum cornu cervi (Reinsch) Hauck Meeresalg. p. 519; *Stylonema cornu cervi* Reinsch (1875) Contrib. Alg. et Fung. p. 40 pl. 15. — Type specimens from the Mediterranean Sea.

Brown Island, Shaw Island, Canoe Island, Peavine Pass; growing on different red algae or on *Sertularia* at a depth of 5—10 fathoms.

Bangia Lyngb. (1819).

Bangia fuscopurpurea (Dillw.) Lyngb. Hydrophyt. Dan. p. 83; Harv. Phyc. Brit. pl. 96; *Conferva fuscopurpurea* Dillw. (1809) Brit. Conf. pl. 92; *Bangia atropurpurea f. fuscopurpurea* Setch. et Gardn. Alg. Northwest. Amer. p. 288; Collins, Holden and Setchell P. B. A. No. 1134; *B. vermicularis* Tilden Amer. Alg. No. 333. — Type specimens from England.

Shaw Island (Muenscher 1916 p. 208); Orcas Island (Setchell and Gardner 1903 p. 288).

Porphyra Ag. (1824).

A) Frond monostromatic.
  1) Frond brownish-purple; growing on rocks and stones.
    a) Frond monoecious, 60—140 μ thick, lanceolate or irregular, very much lobed and laciniate, with cordate base ..... *P. perforata.*

b) As the former, but frond 45—60 μ thick..... *P. p. f. segregata.*

c) Frond dioecious, 75—150 μ thick, linear with cuneate base *P. p. f. lanceolata.*

2) Frond red-purple, 25—60 μ thick, growing on *Nereocystis*.... *P. nereocystis.*

3) Frond wine-red to blue-purple, 25—30 μ thick, growing on *Zostera* or *Phyllospadix* ..... *P. naiadum.*

B) Frond distromatic.

1) Frond monoecious with antheridia and sporocarps intermixed in a marginal zone, 50—80 μ thick, broadly elliptical; each antheridium consisting of 16 antherozoids ..... *P. amplissima.*

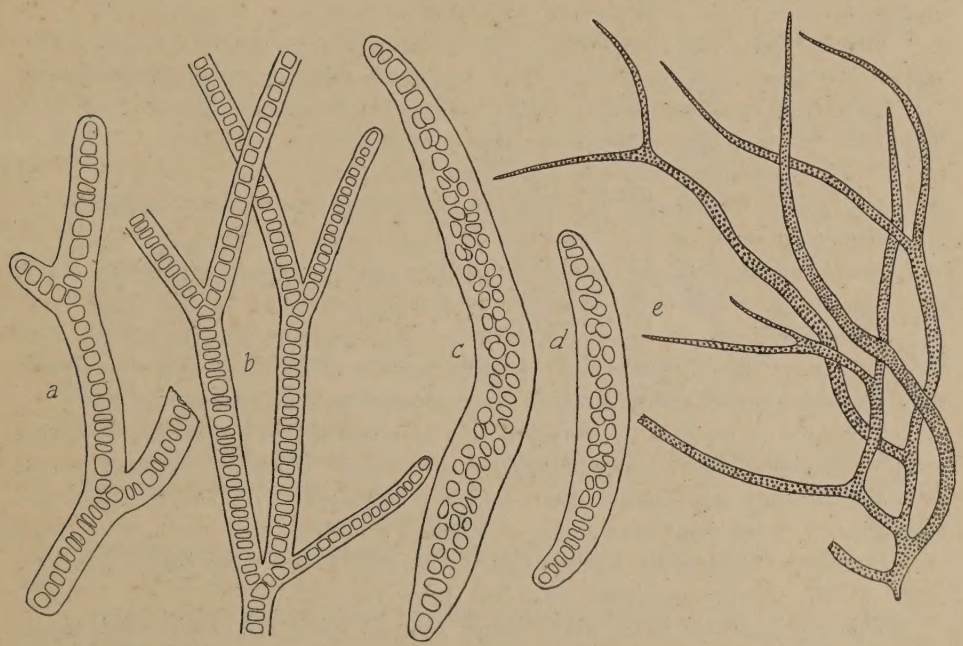

Fig. 1. *a—b Goniotrichum elegans; c—e Goniotrichum cornu cervi.* — *a* × 390; *b* × 285; *c—d* × 390; *e* × 50.

2) As the former, but frond 30—75 μ thick, lanceolate; each antheridium consisting of 8 antherozoids..... *P. miniata f. cuneiformis.*

3) Frond dioecious, 100—220 μ thick, obovate to lanceolate..... *P. variegata.*

C) Frond monostromatic or distromatic, 25 μ thick ..... *P. abyssicola.*

Porphyra perforata J. Ag. (1882) Till Alg. Syst. VI p. 69; Hus Porph. Pac. Coast p. 202. — Type specimens from California.

f. segregata Setch. et Hus (1900) in Zoe Vol. 5 p. 64. — Type specimens from the west coast of U. S. A., Wash. to Calif.

f. lanceolata Setch. et Hus (1900) in Zoe Vol. 5 p. 65. — Type specimens from California.

A very common species growing on rocks and stones in the litoral and upper sublitoral zones. The *f. segregata* is a dwarf form of *P. perforata*. According to my opinion the *f. lanceolata* represents a distinct species, not a form of *P. perforata;* I got it only once, viz. at Kanaka Bay (San Juan Island).

Porphyra nereocystis Anderson (1891) in Zoe Vol. 2 p. 221 (name only), in Zoe Vol. 3 p. 149 (descr.); Hus Porph. Pac. Coast. p. 210. — Type specimens from California.

San Juan Island, near the new marine station.

Porphyra naiadum Anderson (1892) in Zoe Vol. 3 p. 148; Hus Porph. Pac. Coast p. 212. — Type specimens from California.

Brown Island; San Juan Island, south of False Bay. — Hus (1902 p. 213) distinguishes two forms, *f. major* growing on *Zostera* and *f. minor* growing on *Phyllospadix*.

Porphyra amplissima (Kjellm.) Setch. et Hus in Zoe Vol. 5 p. 67; Hus Porph. Pac. Coast p. 215; *Diploderma amplissimum* Kjellm. (1883) Alg. Arct. Sea p. 188. — Type specimens from the Norwegian Polar Sea.

San Juan Island, near the new marine station; on rocks and stones in the upper sublitoral zone.

Porphyra miniata Ag. Syst. Alg. p. 191; *Ulva purpurea* β *miniata* Ag. (1817) Syn. Alg. Scand. p. 42. — Type specimens from Greenland.

f. cuneiformis Setch. et Hus (1900) in Zoe Vol. 5 p. 68; Hus Porph. Pac. Coast p. 218. Collins, Holden and Setchell P. B. A. No. 929. — Type specimens from the west coast of North America (from Alaska to Middle California).

This form is reported by Setchell and Gardner (1903 p. 291) from the west coast of Whidbey Island, and probably it also will be found at San Juan Island. According to my opinion this form which is monoecious is more related to the monoecious *P. amplissima* than to the dioecious *P. miniata.*

Porphyra abyssicola Kjellm. (1883) Alg. Arct. Sea p. 191; Hus Porph. Pac. Coast p. 223. — Type specimens from the Arctic Sea.

This species which is not very distinct from *P. miniata f. cuneiformis* is reported from the west coast of Whidbey Island by Setchell and Gardner (1903 p. 291).

Porphyra variegata Kjellm. in Zoe Vol. 5 p. 69; Hus Porph. Pac. Coast p. 225; Collins, Holden and Setchell P. B. A. No. 930; *Diploderma variegatum* Kjellm. (1889) Beringh. Algfl. p. 33. — Type specimens from Bering Island.

Reported from the west coast of Whidbey Island by Setchell and Gardner (1903 S. 291).

Erythrotrichia Aresch. (1850).

Erythrotrichia Bertholdii Batt. (1900) Journ. of Bot. Vol. 38 p. 375; Hamel in Revue Alg. Tom. I p. 287. — Type specimens from the Mediterranean Sea (Neapel).

With some hesitation I have referred an *Erythrotrichia* species to the little-known *E. Bertholdii*. In fig. 2 I give some drawings of the species. The old erect filaments are 25—35 μ thick, unbranched, 1—2 mm high. The segments are 0,5—1 times as long as broad and generally divided by longitudinal walls. There is no true basal disk, but a few horizontal cells are developed at the base. *E. Bertholdii* differs from *E. carnea* in having shorter segments and longitudinal walls, from *E. ciliaris* in lacking a true basal disk.

Brown Island, Shaw Island, Peavine Pass; dredged in a depth of 5—10 fathoms, growing on different red algae or on *Sertularia;* with monospores.

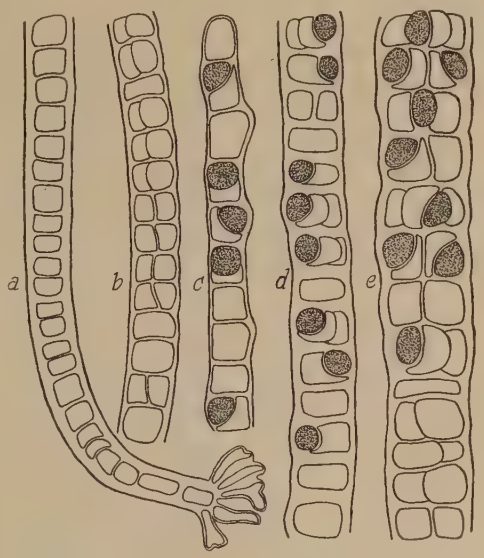

Fig. 2. *Erythrotrichia Bertholdii*. *a—c* lower, middle and upper part of one and the same filament. — × 390.

Erythrocladia Rosenv. (1909).

1) Frond consisting of a monostromatic disk with irregularly radiating filaments and an irregular margin; no bifurcating cells in the margin. *E. irregularis.*
2) Frond consisting of a monostromatic disk with regularly radiating filaments and a regular margin; many bifurcating cells in the margin. *E. subintegra.*

Erythrocladia irregularis Rosenv. (1909) Mar. Alg. Denm. p. 72. — Type specimens from Denmark.

Shaw Island, Peavine Pass; growing on *Sertularia* at a depth of 5—10 fathoms; with monospores.

Erythrocladia subintegra Rosenv. (1909) Mar. Alg. Denm. p. 73. — Type specimens from Denmark.

Shaw Island, Peavine Pass; growing on *Sertularia* at a depth of 5—10 fathoms; with monospores.

These two *Erythrocladia* species agree very well with the descriptions given by Rosenvinge, and also with specimens I have seen from the west coast of Sweden. In fig. 3 I give some drawings of the two species.

Porphyropsis Rosenv. (1909).

Porphyropsis coccinea (J. Ag.) Rosenv. Mar. Alg. Denm. p. 69; *Porphyra coccinea* J. Ag. (1836) Nov. Fl. Svec. p. 6 (without description); Aresch. Phyc. Scand. mar. p. 181 pl. 1. — Type specimens from the west coast of Sweden.

Peavine Pass, growing on *Sertularia* at a depth of 5—10 fathoms; with monospores.

Of this species I have only seen a few individuals about 1—2 mm high; the European form is 5—10 mm high. I have referred my specimens to *P. coccinea*

Fig. 3. *a—b Erythrocladia irregularis; c—g Erythrocladia subintegra; h Porphyropsis coccinea,* part of the frond with monospores. — *a—g* × 625; *h* × 950.

because the development of the frond and of the monospores agrees very well with the development in this species (cfr. fig. 3 *h*).

Nemalionales.

Fam. Helminthocladiaceae.

Acrochaetium Näg. (1861).

1) Erect filaments unbranched, 20—30 μ high, with terminal monospores. *A. Desmarestiae.*
2) Erect filaments branched, about 1 mm high., with monospores on one- or two-celled branchlets ..... *A. pacificum.*

Acrochaetium Desmarestiae Kylin nov. sp.

Epiphytic on *Desmarestia latissima* with a well-developed unistratose basal disk, 3—5 mm in diameter, consisting of more or less coherent creeping filaments; erect

filaments unbranched, 20—30 μ high and 3—4 μ broad, consisting of 3—6 cells; no hairs; monosporangia terminal on the erect filaments, 5—6 μ broad and 7—8 μ long [1].

Canoe Island, Turn Island; growing on *Desmarestia latissima* at a depth of 5—10 fathoms; with monospores.

This new species seems to be related to *Chantransia (Acrochaetium) humilis* and *Ch. reducta*, described by Rosenvinge (1909) from the coast of Denmark, but is in many characters easely distinguished from them.

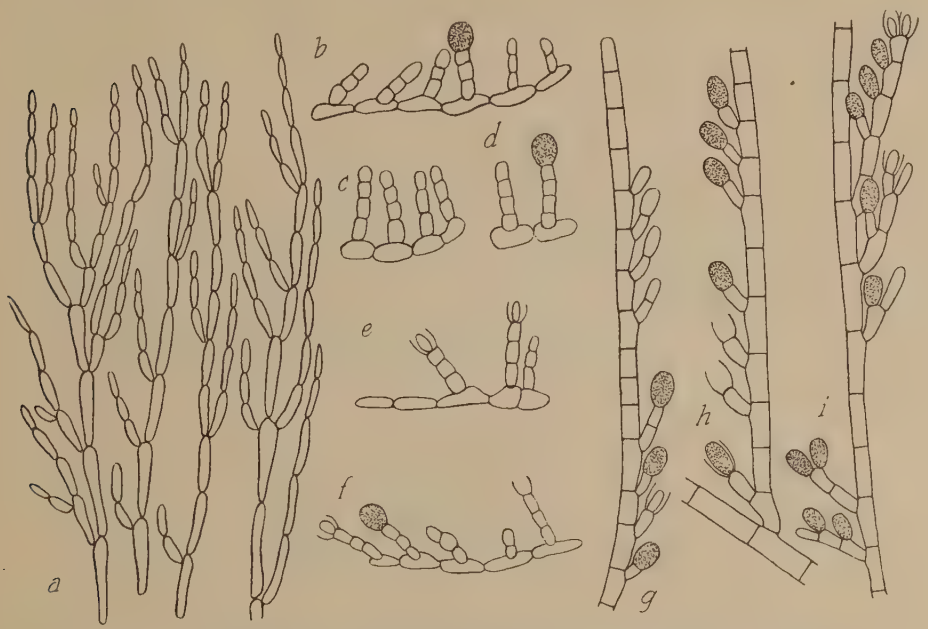

Fig. 4. *a—f Acrochaetium Desmarestiae.* *a* filaments in the margin of the basal layer; *b—f* creeping filaments with upright branches; *g—i Acrochaetium pacificum* erect filaments with monospores. — × 520.

Acrochaetium pacificum Kylin nov. sp.

Epiphytic on different red algae or growing on *Sertularia;* basal disk unistratose, consisting of more or less coherent creeping filaments; erect filaments about 1 mm high, irregularly and more or less richly branched; cells 4,5—5,5 μ thick, 2—4 times as long as broad; generally no hairs; monosporangia 5,5—6,5 μ broad

[1] *Acrochaetium Desmarestiae* Kylin nov. sp. — Frons ad frondes *Desmarestiae latissimae* epiphytica; discus basalis bene evolutus, 3—5 mm latus, unistratus, e filis repentibus plus minus laxe cohaerentibus formatus; fila erecta laxiuscule caespitosa, non ramosa, 20—30 μ alta et 3—4 μ lata, e 3—6 cellulis composita; pila nulla; monosporangia terminalia in apicibus filorum erectorum inserta, 5—6 μ lata et 7—8 μ longa.

and 8—10 μ long, single or two or three on small, one- or two-celled, usually secundate, sometimes irregularly alternate branchlets [1].

Brown Island, Shaw Island, Peavine Pass; growing on different red algae or on *Sertularia* at a depth of 5—10 fathoms; with monospores.

This new species belongs to the group of *Acrochaetium*-species, which is represented on the European coasts by *Chantransia (Acrochaetium) Daviesii* and *Ch. attenuata* (Rosenvinge 1909). In the West Indies the group is represented by *Acrochaetium gracile*, *A. globosum*, *A. seriatum* and *A. flexuosum* (Børgesen 1915). *Acrochaetium clandestinum*, described by Howe (1914 p. 86) from the coast of Peru, also belongs to this group. My species does not agree with any of these, and thus I have described it as a new one.

Fam. Chaetangiaceae.

Gloiophloea J. Ag. (1871).

Gloiophloea confusa Setch. (1914) in Univ. Calif. Publ. Bot. Vol. 6 p. 118; *Scinaia furcellata* var. *undulata* Setch. in Collins, Holden and Setchell P. B. A. No. 422. — Type specimens from the west coast of U. S. A.

Near Cattle Point, San Juan Island; a male plant dredged at a depth of 10 fathoms.

Whidbeyella Setch. et Gardn. (1903).

Whidbeyella cartilaginea Setch. et Gardn. (1903) Alg. Northw. Amer. p. 295. — Type specimen from Whidbey Island, Wash.

Westcoast of Whidbey Island (Setchell and Gardner 1903 p. 295).

Gelidiales.

Fam. Gelidiaceae.

Gelidium Lamour. (1813).

1) Stem generally naked in the lower half, pinnate above the middle; colour very dark brownish to purple-red ..... *G. cartilagineum.*
2) Stem pinnate from the base; colour red to slightly purplish red; slenderer than the former ..... *G. Amansii.*

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[1] *Acrochaetium pacificum* Kylin nov. sp. — Discus basalis unistratus e fillis lateraliter confluentibus compositus; fila erecta usque ad 1 mm longa, irregulariter ramosa; cellulae 4,5—5,5 μ crassae, diametro 2—4-plo longiores; pili nulli aut rarissimi; monosporangia 5,5—6,5 μ lata, 8—10 μ longa, in ramulis 1—2-cellularibus singula vel bina vel terna; ramuli sporiferi secundi vel rarius irregulariter subalterni.

Gelidium cartilagineum (L.) Gaill. Resum. p. 15; Kütz. Tab. Phyc. 18 pl. 41; Harv. Phyc. Brit. pl. 337; *Fucus cartilagineus* L. (1763) Sp. Plant. 2 p. 1630; Turn. Hist. Fuc. pl. 124. — Type specimens »in Oceano australiore».

San Juan Island, south of False Bay; on rocks in the upper sublitoral zone; with tetraspores.

My specimens are comparatively small, only about 6 cm high, but decidedly they belong to this species, not to the following one.

Gelidium Amansii Lamour. Essai p. 41; Kütz. Tab. Phyc. 18 pl. 44; Okam. Icon. Jap. Alg. Vol. 3 p. 25 pl. 106; *Fucus Amansii* Lamour. (1805) Dissert. p. 48 pl. 26; *Gelidium latifolium* Tilden Amer. Alg. No. 513. — Type specimens from the islands Francia and Madagascar.

Orcas Island (Setchell and Gardner 1903 p. 295).

Asparagopsis Mont. (1840).

Asparagopsis hamifera (Hariot) Okam. Icon. Jap. Alg. Vol. 4 p. 131 pl. 183—184; *Bonnemaisonia hamifera* Hariot Alg. de Yokoska p. 223; Collins, Holden and Setchell P. B. A. No. 939. — Type specimens from Japan (Yokoska).

San Juan Island, on the piles of Friday Harbor's docks; Turn Island, Canoe Island; dredged at a depth of 5—10 fathoms; with cystocarps.

Cryptonemiales.

Fam. Dumontiaceae.

Thuretellopsis Kylin nov. gen.

Frond irregularly branched; branches with a central filament of big cells, each of these with a verticil consisting of densely branched cell filaments; verticils confluent on account of the growth of interverticillary filaments; carpogonial branches and auxiliary cell branches distinctly separated from each other; cystocarps enclosed in the verticils [1].

Thuretellopsis Peggiana Kylin nov. sp.

Characters the same as those of the genus.

Near Friday Harbor, San Juan Island; dredged at a depth of about 10 fathoms; with cystocarps.

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[1] *Thuretellopsis* Kylin nov. gen. Dumontiacearum. — Frons teres, gelatinosa, irregulariter ramosa, e tubo articulato, monosiphonio, crasso, atque e filis peripheric is, ramosissimis, verticillatim ordinatis, stratum subcontinuum formantibus, constituta; ramuli carpogonici a ramulis cellularum auxiliarium distincte separati; cystocarpia in verticillis inclusa; antheridia et sporangia ignota. — E genere Thuretella ramulis carpogonicis a ramulis cellularum auxiliarium separatis differt.

Thuretellopsis Peggiana Kylin nov. sp. — Characteres generis.

Of this new species I have only a fragment, about 1 cm high. As to the vegetative structure it is very similar to *Thuretella Schousboei*, but it can not be referred to this species because of the difference concerning the carpogonial branches. In *Thuretella* these branches are directely connected with the auxiliary cell branches (Hassencamp 1902 p. 67), in *Thuretellopsis* these two kinds of branches are distinctly separated from each other. *Thuretella* belongs to the family Gloiosiphoniaceae, *Thuretellopsis* to the family Dumontiaceae.

In fig. 5 I have given some drawings of the carpogonial branches and the auxiliary cell branches in *Thuretellopsis*. Generally these branches develop from the lowest cell in the filaments of the verticils, mostly from its lower side, and consist of 5—7 cells; the first two cells sometimes have side branches (fig. 5 *b*—*c*). After the fertilization the carpogon joins one of the cells in the middle of the carpogonial branch and afterwards this cell gives off sporogenous filaments, growing out in the direction

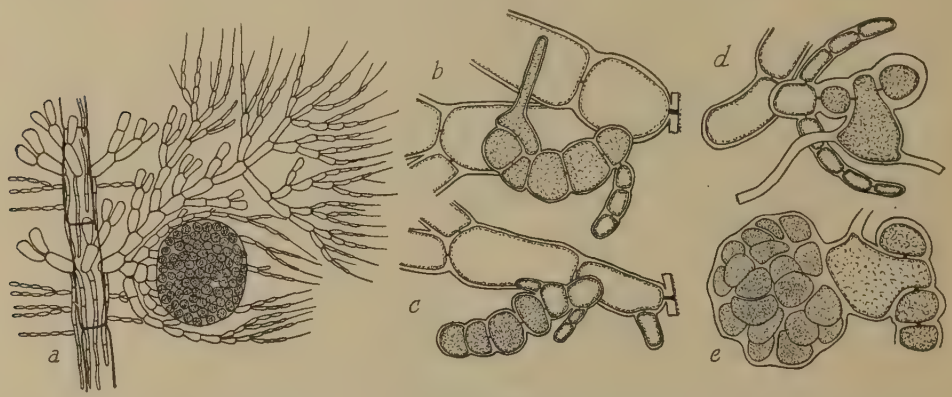

Fig. 5. *Thuretellopsis Peggiana*. *a* central filament with a part of a verticil and a mature gonimoblast; *b* carpogonial branch; *c* auxiliary cell branch; *d* auxiliary cell after the junction with a sporogenous filament; *e* young gonimoblast. — *a* × 100; *b*—*e* × 700.

of the auxiliary cell branches. The upper 3—4 cells in these branches have a very dense content, and they represent auxiliary cells. The sporogenous filament mostly joins one of the middlemost of them, and then the gonimoblast grows out from this cell. All the cells in the gonimoblast generate carpospores. — The development of the carpogonial branches, the auxiliary cell branches, the sporogenous filaments and of the gonimoblasts in *Thuretellopsis* is very much alike the development of these different things in *Dumontia* (Kylin 1923 p. 10).

Cryptosiphonia J. Ag. (1876).

Cryptosiphonia Woodii J. Ag, Epicr. p. 251; *Pikea Woodii* J. Ag. (1872) Bidr. Florid. Syst. p. 15; *Cryptosiphonia Grayana* Collins, Holden and Setchell P. B. A. No. 1047. — Type specimens from Vancouver Island.

San Juan Island, north of Point Caution; on rocks in the litoral zone; with cystocarps and tetraspores.

Cryptosiphonia Grayana, described by J. Agardh (1872 p. 15) on specimens from Vancouver Island, is identical with *Cr. Woodii*. The type specimens of *Cr. Woodii* in J. Agardh's herbarium represent some old fragments, and the type specimens of *Cr. Grayana* good individuals of one and the same species.

Farlowia J. Ag. (1876),

Farlowia mollis (Harv. et Bail.) Farl. et Setch. in Collins, Holden and Setchell P. B. A. Nr. 898; *Gigartina mollis* Harv. et Bail. (1851) in Proc. Boston Soc.

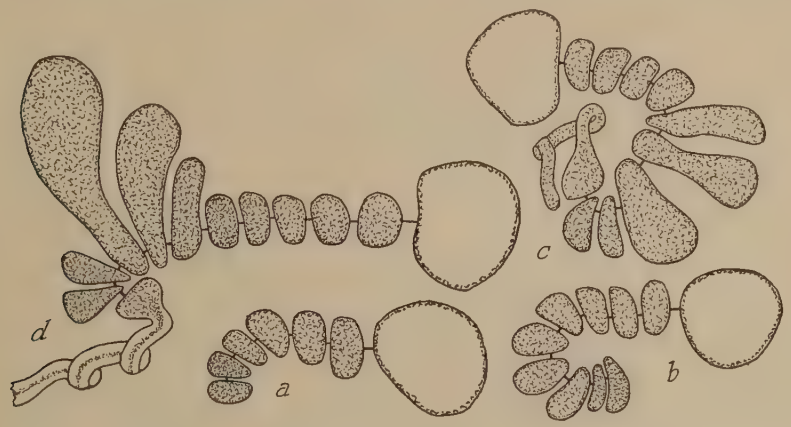

Fig. 6. *Weeksia Fryeana*. Carpogonial branches in different stages of development. — × 620.

Nat. Hist. Vol. 3 p. 372; Harv. Ner. Bor. Amer. 2 p. 175. — Type specimens from Puget Sound.

San Juan Island, north of Point Caution and south of False Bay; on rocks in the lower part of the litoral and the upper part of the sublitoral zones.

Weeksia Setch. (1901).

Weeksia Fryeana Setch. (1912) in Univ. Calif. Publ. Bot. Vol. 4 p. 254. — Type specimens from Orcas Island and San Juan Island, Wash.

Canoe Island; dredged at a depth of 10 fathoms.

In fig. 6 I have given some drawings of carpogonial branches in *Weeksia Fryeana*. These branches consist of about 9—10 cells, of which the lowest 4—5 are rather small, the three next ones very large, the two next ones again rather small, and then we have the carpogonial cell itself with a long, irregularly twisted

trichogyne. I cannot tell anything about the development of the gonimoblasts, as my specimens only were provided with unfertilized carpogons.

Constantinea Post. et Rupr. (1840).

Constantinea subulifera Setch. (1906) in Nuov. Notar. Ser. 17 p. 172; *C. sitchensis* Setch. and Gardn. Alg. Northwest. Amer. p. 356 pl. 18; Tilden Amer. Alg. No. 203; Collins, Holden and Setchell P. B. A. No. 950. — Type specimens from the region of Puget Sound.

San Juan Island near the new marine station; Brown Island; on rocks in the upper sublitoral zone; all specimens sterile.

Fam. **Gloiosiphoniaceae.**

Gloiosiphonia Carm. (1833).

1) Frond richly and irregularly branched ..... *Gl. californica.*
2) Frond throughout its length clothed with whorls of 3—6, about one cm long branches *Gl. verticillaris.*

Gloiosiphonia californica (Farl.) J. Ag. Till Alg. Syst. VII p. 10; *Nemastoma californica* Farl. (1877) in Proceed. Amer. Acad. Arts and Sc. Vol. 12 p. 243; *Calosiphonia californica* J. Ag. Anal. Alg. Contin. V p. 83. — Type specimens from California.

Pleasant Beach, Kitsap County, Wash. (Setchell and Gardner 1903 p. 348).

I have examined the specimens of this species in J. Agardh's herbarium; they are collected at the Californian coast. They belong to the family Gloiosiphoniaceae, not to Nemastomaceae, and thus they can not be referred to the genus *Calosiphonia.*

Gloiosiphonia verticillaris Farl. (1889) in Bull. Torr. Bot. Club Vol. 16 p. 90 pl. 88; Tilden Amer. Alg. No. 205. — Type specimens from California.

West coast of Whidbey Island, Wash., on stones in the upper sublitoral zone (Setchell and Gardner 1903 p. 348).

Gloiopeltis J. Ag. (1842).

Gloiopeltis furcata (Post. et Rupr.) J. Ag. Spec. Alg. 2 p. 235; Tilden Amer. Alg. No. 305; Collins, Holden and Setchell P. B. A. No. 945; *Dumontia furcata* Post. et Rupr. (1840) Illustr. Alg. p. 19. — Type specimens from North Pacific Ocean.

Common on rocks in the upper litoral zone; with cystocarps and tetraspores.

Fam. Grateloupiaceae.

Aeodes J. Ag. (1876).

Aeodes Gardneri Kylin nov. sp.; *Aeodes nitidissima* Setch. et Gardn. Alg. Northwest. Amer. p. 349 (non J. Ag. Epicr. p. 680); Collins, Holden and Setchell P. B. A. No. 946.

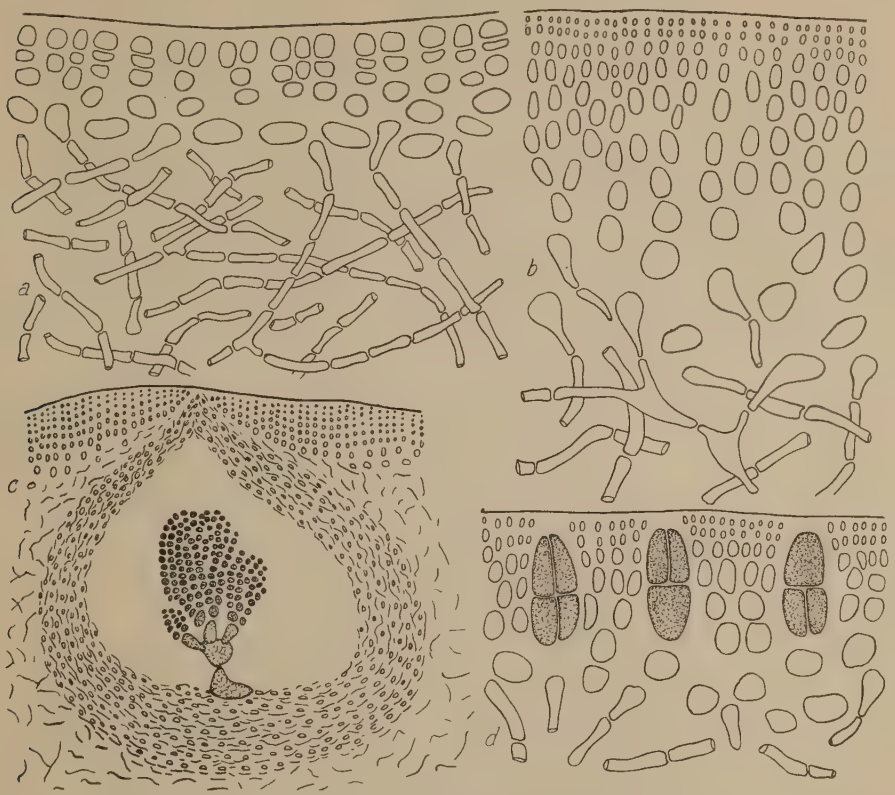

Fig. 7. *a Aeodes Gardneri* cross section; *b—d Aeodes nitidissima; b* cross section; *c* cystocarp; *d* tetraspores. — *a—b* × 710; *c* × 220; *d* × 530.

Frond large, blade-like, more or less obovate or lanceolate, undivided or a little laciniate; cross section with a medullary layer of much intertwined filaments and two cortical layers, each consisting of branched or unbranched rows of cells with 4—6 cells in each row; the interior and the exterior cells without any greater difference in size; cystocarps densely scattered over the surface, small, about 0,2—0,3 mm in diameter, immersed; the special filaments covering the cystocarps not very numerous [1].

[1] *Aeodes Gardneri* Kylin nov. sp. — Frons ampla, foliacea, plus minus obovata vel lanceolata, integra vel parce laciniata; stratum medullare e filamentis intertextis constitutum; fila verticalia

West coast of Whidbey Island, Wash.; cast ashore, probably growing in the sublitoral zone at a depth of several fathoms (Setchell and Gardner 1903 p. 349).

Setchell and Gardner have identified this species with *Aeodes nitidissima*, described by J. Agardh on specimens from New Zealand. I have seen the type specimens of *Aeodes nitidissima* in J. Agahdh's herbarium; they represent quite another species than that one, distributed under this name in Collins, Holden and Setchell P. B. A. No. 946, and then mentioned by Setchell and Gardner 1903 p. 349; therefore I describe the specimens from Whidbey Island as a new species.

The cross sections reproduced in fig. 7 *a—b* show the difference between *A. Gardneri* and *A. nitidissima* as to the cortical layer of the frond. This layer is in *A. nitidissima* much thicker than in *A. Gardneri*, and the exterior cells are in the former species much smaller than the interior ones; in the latter species there is not such a great difference between the exterior and the interior cells. Then there is a great difference in the development of the filaments covering the gonimoblasts. Fig. 7 *c* shows a cross section through a cystocarp of *A. nitidissima* with the wall, consisting of very numerous, intertwined filaments. In the cystocarpic wall in *A. Gardneri* there are only a few covering filaments, about the same as in *Cryptonemia* (fig. 8 *e*). Probably *A. Gardneri* has to be described as a new genus.

Setchell says (1901 p. 126) that *Aeodes nitidissima* occurs on the Californian coast. I have not seen any *Aeodes* specimens from this coast, but I hardly think that Setchell's specimens represent the true *Aeodes nitidissima* J. Ag. — Muenscher (1915 p. 78) reports an *Aeodes nitidissima* from San Juan Island, Wash. I do not know which alga he refers to with this name.

Grateloupia Ag. (1822).

1) Frond 20—60 cm long, 20—40 mm broad, simple, or more or less pinnate ..... *Gr. Cutleriae.*

2) Frond 7—10 cm long, 7—10 mm broad, pinnate ..... *Gr. pinnata.*

Grateloupia Cutleriae (Bind.) Kütz. Phyc. Gen. p. 398; Tab. Phyc. 17 pl. 37; Collins, Holden and Setchell P. B. A. Fasc. D No. XCIX; *Iridaea Cutleriae* Bind. (1846) in Mont Voy. Bonite p. 63. — Type specimens from Chile, near Valparaiso.

West coast of Whidbey Island, cast ashore from the upper sublitoral zone (Setchell and Gardner 1903 p. 349); San Juan Island and Shaw Island (Muenscher 1915 p. 78 and 1916 p. 207).

Grateloupia pinnata (Post. et Rupr.) Setch. in Collins, Holden and Setchell P. B. A. No. 947; *Iridaea pinnata* Post. et Rupr. (1840) Illustr. Alg. p. 18; *Gigartina microphylla* Tilden Americ. Alg. No. 222; [non *Grateloupia pinnata* (Hook. et Harv.) J. Ag. Epicr. p. 151]. — Type specimens from Norfolk (near Sitka), Alaska.

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strati corticalis simplicia vel ramosa, e 4—6 cellulis composita; cellulae corticales interiores exterioribus non multo majores; cystocarpia numerosissima, parva, diam. 0,2—0,3 mm, per frondem sparsa, immersa; stratum circumnucleare e filis paucis, laxe intertextis constitutum.

Tracyton, Kitsap County, Wash. (Tilden l. c.); cfr. Setchell and Gardner 1903 p. 349—350.

Prionitis J. Ag. (1851).

Prionitis Lyallii Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 173. — Type specimens from Vancouver Island and Fuca Strait, Wash.

f. ornata Harv. l. c.; Collins, Holden and Setchell P. B. A. No. 949.

f. normalis Harv. l. c.; *Farlowia compressa* Tilden Amer. Alg. No. 302.

f. densissima Harv. l. c.; *Prionitis lanceolata* Tilden Amer. Alg. No. 303.

Common on rocks in the litoral zone.

Of this very variable species I think we can distinguish the three above-mentioned forms in the vicinity of Friday Harbor, Wash. The *f. ornata* is the largest of them with a frond 20—30 cm high and 2—3 cm broad; it is nearly related to, or may be identical with *Prionitis Andersoniana* Eaton (J. Ag. Epicr. p. 159) from the Californian coast, and occurs on coasts with surf. The *f. normalis* ist 10—15 cm high and the main branches 3—5 mm broad; it occurs on coasts without surf. The *f. densissima* is of the same size as *f. normalis* or sometimes a little smaller or a little larger, but is very densely branched; it occurs in tide pools in the upper litoral zone.

Cryptonemia J. Ag. (1842).

Cryptonemia borealis Kylin nov. sp.; *Cryptonemia obovata* Collins, Holden and Setchell P. B. A. No. 1748 (non No. 550).

Frond blade-like, about 60—70 μ thick, from a 0,5—2 cm long stipe, orbicular or broadly lanceolate, nearly 30 cm high, simple or irregularly laciniate, proliferating from the cuneate base; medullary layer of a lax structure, consisting of some irregular filaments; cortical layer with one row of assimilating cells and between this row and the medullary layer one or two rows of irregular cells; cystocarps small, 0,1—0,15 mm in diameter, immersed, scattered over the frond; tetrasporangia cruciate, scattered, immersed in the cortical layer [1].

Canoe Island, Peavine Pass; dredged at a depth of 5—10 fathoms; rather common; with cystocarps and tetrasporangia.

This new species is nearly related to *Cryptonemia obovata*, described by J. Agardh (1876 p. 681) on specimens from Golden Gate, Calif. The structure in *Cr. obovata* is, however, much denser than in *Cr. borealis;* the cells in the medullary layer of the former are shorter than those ones in the latter, and they are closer

[1] *Cryptonemia borealis* Kylin nov. sp. — Frons foliacea, 60—70 μ crassa, 0,5—2 cm longe stipitata, orbicularis vel late lanceolata, usque ad 30 cm alta, integra vel parce lobata vel laciniata, e basi cuneata prolifera; stratum medullare structura laxa, e filamentis irregularibus constitutum; stratum corticale e duabus vel tribus seriebus cellularum compositum; cystocarpia parva, diam. 0,1—0,15 mm, inclusa, per frondem sparsa; tetrasporangia sparsa, in cortice immersa, cruciatim divisa.

to each other in *Cr. obovata* than in *Cr. borealis* (cfr. fig. 8 *a* and *b*). — In Collins, Holden and Setchell P. B. A. No. 550 *a* there is a plant, collected at San

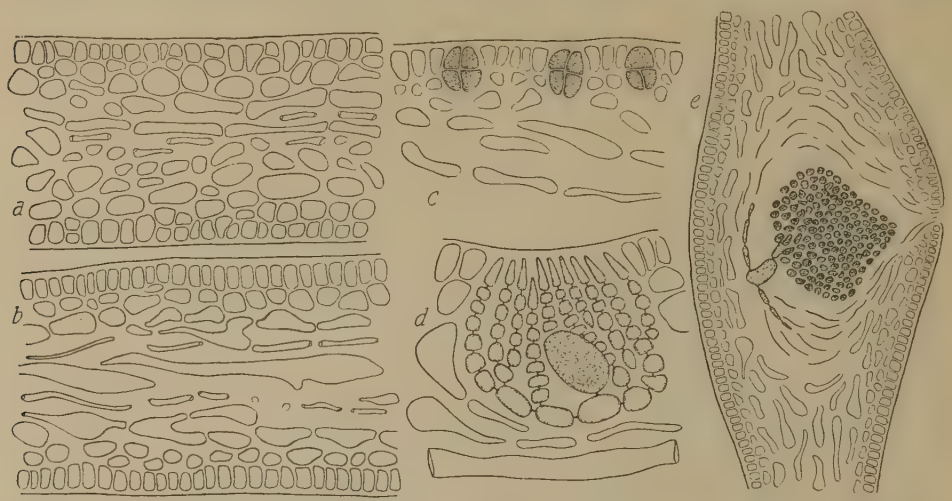

Fig. 8. *a Cryptonemia obovata,* cross section; *b—e Cryptonemia borealis; b* cross section; *c* tetraspores; *d* auxiliary cell with surrounding filaments; *e* cystocarp. — *a–c* × 400; *d* × 700; *e* × 200.

Fig. 9. *Cryptonemia borealis* — 2/5 nat. size.

Fransisco, Calif., and named *Cryptonemia obovata.* It is a fragment of a species related to *Cr. obovata,* but the anatomical structure shows that it is not the true

Cr. obovata J. Ag. The medullary layer consists of quite a lot of long and intertwined filaments and the cortical layer is much thicker than in the true *Cr. obovata*.

Harvey (1862 p. 174) has described a species, dredged in 14 fathoms, Graffins Bay, San Juan Island, under the name of *Schizymenia? coccinea*. At first I thought that this species could be *Cryptonemia borealis*. Through the courtesy of Prof. Dr. H. Dixon in Dublin I have got the opportunity to examine some fragments of Harvey's type specimen, and then I found that *Schizymenia? coccinea* and *Cryptonemia borealis* do not represent one and the same species. The fragments of *Schizymenia? coccinea* are sterile, and I think it is impossible to tell what this species really is. Setchell and Gardner (1903 p. 356) write in regard to *Sch. coccinea* Harv. »We have been able to examine a small fragment of the type preserved in Herb. Farlow, and while we cannot be certain, we think that it is the same plant we have placed under *Aeodes nitidissima*». As to my opinion *Sch. coccinea* is not *Aeodes nitidissima* Setch. et Gardn. (= *A. Gardneri* Kylin; cfr. p. 19); may be it is *Weeksia Fryeana* (cfr. p. 15), —. Muenscher (1915 p. 78) reports an alga from San Juan Island under the name of *Schizymenia coccinea* Harv.; I do not know which alga he refers to with this name.

Fam. **Nemastomaceae.**

Turnerella Schmitz (1889).

Turnerella pacifica Kylin nov. sp.; *Sarcophyllis californica* Setch. et Gardn. Alg. Northwest. Amer. p. 354 (non J. Ag. Epicr. p. 265); Collins, Holden and Setchell P. B. A. No. 395; *Turnerella Mertensiana* Tilden Americ. Alg. No. 323.

Frond membranous, orbicular, reniform or lanceolate up to 50 cm or more in diameter, sometimes irregularly laciniate; frond 250—350 μ thick; cortical layer with colourless, 8—15 μ broad and 20—60 μ long, glandular cells; cystocarps densely scattered over the frond, immersed in the medullary layer, with a small opening through the cortex, 125—175 μ in diameter; tetrasporangia unknown [1].

San Juan Island, on the piles of Friday Harbor's docks and south of False Bay; Brown Island, Turn Rock, Canoe Island; mostly on stones in the upper sublitoral zone; with cystocarps.

This species is nearly related to *Turnerella Mertensiana*, described by Postels and Ruprecht (1840 p. 18 pl. 33) from Kamtshatka under the name of *Iridaea Mertensiana*. The latter species is, however, thicker and more cartilaginous than the former and does not stick to the paper; *T. pacifica* sticks very well to the paper. Further we have a difference concerning the glandular cells; these are in *T. Mer-*

[1] *Turnerella pacifica* Kylin nov. sp. — Frons membranacea, orbicularis, reniformis vel lanceolata, ampla, saepe 50 cm et ultra longa, nonnumquam irregulariter laciniata; stratum corticale cellulis glandulinis, incoloratis, 8—15 μ latis, 20—60 μ longis ornatum; cystocarpia per frondem dense dissipata, immersa, diam. 125—175 μ, carpostomio aperto; tetrasporangia ignota.

tensiana pear-shaped, 35—70 μ broad and 60—90 μ long (measured on type specimens in J. Agardh's herbarium), in *T. pacifica* cylindrical, 8—15 μ broad and 20—60 μ long.

The genus *Turnerella* is by Schmitz (1889) referred to the family Rhodophyllidaceae; the development of the gonimoblast (fig. 10 *c—d*) shows, however, clearly that this genus belongs to the family Nemastomaceae. *Turnerella* is closely related to *Schizymenia*, but there are not any glandular cells in the latter genus.

Since long ago *Turnerella pacifica* has been known by the American algologists under the name of *Sarcophyllis californica*. I have seen the type specimens of *S.*

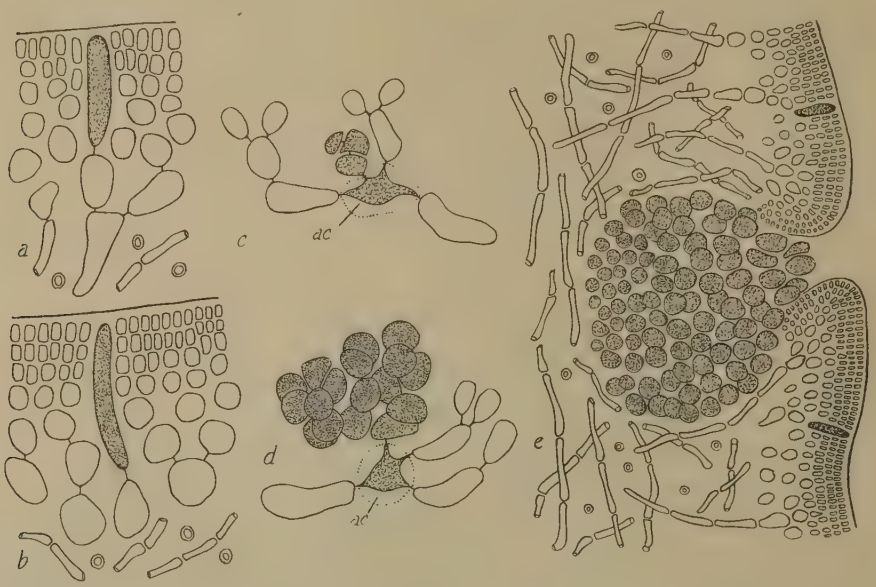

Fig. 10. *Turnerella pacifica*. *a—b* cross sections through the cortical layer with glandular cells; *c—d* jung gonimoblasts; *e* mature gonimoblast. — *ac* auxiliary cell. — *a—b* × 390; *c—d* × 460; *e* × 220.

californica J. Ag. (Epicr. p. 265); they are collected on the Pacific coast of U. S. A. by Farlow: No. 35900 on the coast of Oregon and No. 35898 on the coast of California. The former number, which is specially referred to by J. Agardh in his description of the species, is a female plant with carpogonial and auxiliary cell branches of a kind characteristic of the family Dumontiaceae, but without any gonimoblasts; the latter number represents a sterile specimen. The true *S. californica* is later described by Setchell (1901 p. 126) as a new species under the name of *Dilsea pygmaea* Setch. in Collins, Holden and Setchell P. B. A. No. 396. Thus *Dilsea pygmaea* Setch. is a synonym to *Sarcophyllis californica* J. Ag. [= *Dilsea californica* (J. Ag.) Schmitz in Engler and Prantl Nat. Pflanzenfam. I: 2 p. 520].

Opuntiella Kylin nov. gen.

Frond membranous, cartilaginous, with prolifications from the margin, costate at the base; prolifications orbicular or a little elongate with a short stipe; the inner part of the cortical layer consisting of large, round cells and the outer part of small cells arranged in short filaments vertical to the surface; between the cells in the cortical layer there are colourless, glandular cells, 20—40 μ broad and 40—100 μ long; medullary layer consisting of very intertwined filaments; cystocarps and tetrasporangia unknown[1].

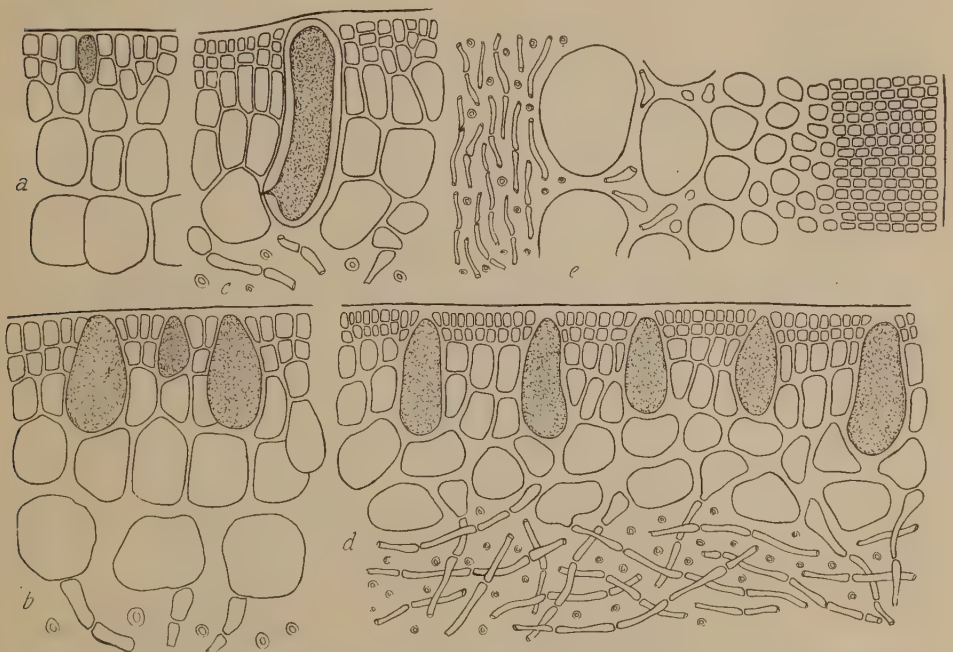

Fig. 11. *Opuntiella californica*. *a—d* cross sections through young fronds with glandular cells; *e* cross section through an old frond. — *a—b* × 460; *c* × 390; *d* × 285; *e* 160.

Opuntiella californica (Farl.) Kylin nov. comb.; *Callymenia californica* Farl. (1877) in Proceed. Amer. Acad. Art and Sc. Vol. 12, p. 241; *Callymenia phyllophora* Setch. et Gardn. Alg. Northwest. Amer. p. 308 (non J. Ag. Bidr. Florid. Syst. p. 9); *Callymenia californica* Collins, Holden and Setchell P. B. A. No. 633; Tilden Americ. Alg. No. 324. — Type specimens from California.

[1] *Opuntiella* Kylin nov. gen. — Frons membranacea, carnosa, e margine radiatim prolifera, inferiore parte costata; prolificationes orbiculares vel paulo elongatae, basi breviter stipitatae; stratum corticale e cellulis interioribus majoribus, et exterioribus minoribus, verticillariter seriatis, constitutum, cellulis glandulinis incoloratis, 20—40 μ latis, 40—100 μ longis ornatum; stratum medullare e filamentis intertextis compositum; cystocarpia et tetrasporangia ignota.

Brown Island; Shaw Island; Canoe Island; Peavine Pass; dredged at a depth of 5—10 fathoms; not fruiting.

Farlow says in his original description of this species: »We first supposed the plant to be *Kallymenia? phyllophora* J. Ag.; but having sent a specimen to Prof. Agardh, he has decided that it is not the species previously sent to him from Vancouver's Island.» I have seen the specimen sent by Farlow to J. Agardh. It has the number 35041 in Agardh's herbarium and is named *Farlowia phyllophora* J. Ag.; this name has never been published. The specimen belongs to the same species which I have collected in the vicinity of Friday Harbor and named *Opuntiella californica.* I also have seen the type specimen of *Callymenia phyllophora* J. Ag.; this is only a small fragment of an alga, and it is impossible to tell what the complete alga has looked like. — *Callymenia californica* Farl. is certainly not identical with *Callymenia phyllophora* J. Ag. In the former there are glandular cells in the cortical layer, in the latter there are no such cells. The fragment of *C. phyllophora* J. Ag. is provided with cystocarps, and the development of these shows that this species probably belongs to the family Grateloupiaceae. J. Agardh (1892 p. 72) has later named his species *Blastophye phyllophora.*

The peculiar glandular cells are previously mentioned by Clara Leavitt (1904 p. 295), but she supposes them to be parasites of an unknown genus. This is, however, not right. The glandular cells belong to the alga itself. They are cut off from surface cells in a young stage of the development of the cortical layer and will become immersed in this layer by the growing out of the surface cells into vertical filaments (fig. 11). They are in pit connection with cells belonging to the alga. The content consist of an albumin substance. — Clara Leavitt has given a good drawing of the alga; she calls it *Callymenia phyllophora.*

Cystocarps are mentioned by Farlow and Leavitt, but the descriptions are rather poor and thus it is impossible to get any idea concerning the systematical position of the genus *Opuntiella;* I myself have only got sterile material.

Fam. **Squamariaceae.**

Petrocelis J. Ag. (1852).

1) Basal layer with anastomosing cells ..... *P. franciscana.*
2) Basal layer without anastomosing cells ..... *P. Middendorffii.*

Petrocelis franciscana Setch. et Gardn. (1917) in Univ. Calif. Publ. Bot. Vol. 6. p. 391 pl. 33. — Type specimens from San Francisco, California.

Brown Island; on rocks in the upper litoral zone; not fruiting.

My specimens are sterile, but they have the basal layer of profusely anastomosing cells, characteristic of this species.

Petrocelis Middendorffii (Rupr.) Kjellm. Alg. Arct. Sea p. 140; *Cruoria Middendorffii* Rupr. Alg. Ochot. p. 328 pl. 18. — Type specimens from the Ochotsk Sea.

West coast of Whidbey Island (Setchell and Gardner 1903 p. 357). The specimens were sterile, but Setchell and Gardner (in Gardner 1917 p. 391) think the species is correctly referred.

Peyssonnelia Decne (1841).

Peyssonnelia pacifica Kylin nov. sp.

Frond with a dark purple-red colour firmly adhering to the substratum, 300—500 μ thick, crustaceous, more or less circular expanded; cells in the basal layer

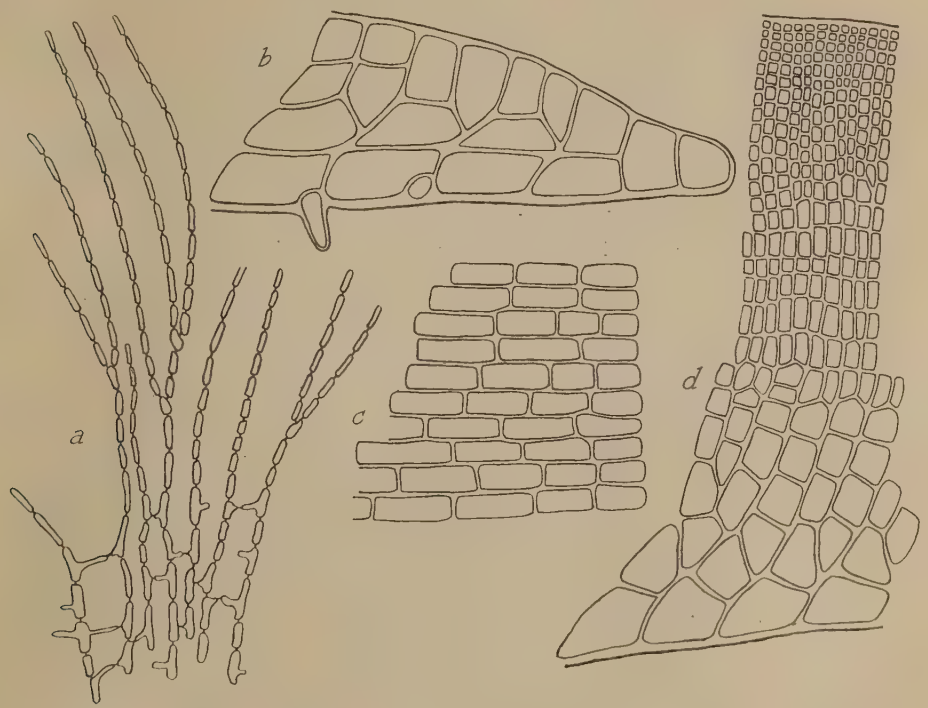

Fig. 12. *a Petrocelis franciscana; b—d Peyssonnelia pacifica; a* margin of the frond; *b* basal layer (hypothallus) from the lower side; *c* frond in cross section. — *a* × 380; *b—e* × 300; *d* × 215.

(hypothallus) 30—40 μ long and 20—30 μ thick; the lowest cells of the erect filaments (perithallus) 20—30 μ high and 15—18 μ broad, the surface cells 4—6 μ high and broad; the male nemathecia about 50 μ high, the female ones about 100 μ high and the tetrasporic ones about 75 μ high; paraphysis unbranched, club-shaped, consisting of 5—8 cells; carpospores about 15 μ in diameter; tetrasporangia 45—55 μ long and 25—30 μ broad with cruciate tetraspores [1].

[1] *Peyssonnelia pacifica* Kylin nov. sp. — Frons purpureo-rubra, substrato firme adhaerens, 300—500 μ crassa, crustacea, plus minus orbiculariter expansa; cellulae strati basalis (hypothalli)

San Juan Island, south of False Bay; growing on *Patella* in the litoral zone; fruiting.

There are many species of *Peyssonnelia* described, but only one mentioned from the Pacific coast of America (Anderson 1891 p. 221), viz. *P. (Curoriella) Dubyi*, but this species is an European one, and probably the American *P. Dubyi* is not correctly named. My plant, in any case, does not belong to the European species. Generally the *Peyssonnelia* species are not very well described, and thus it is rather

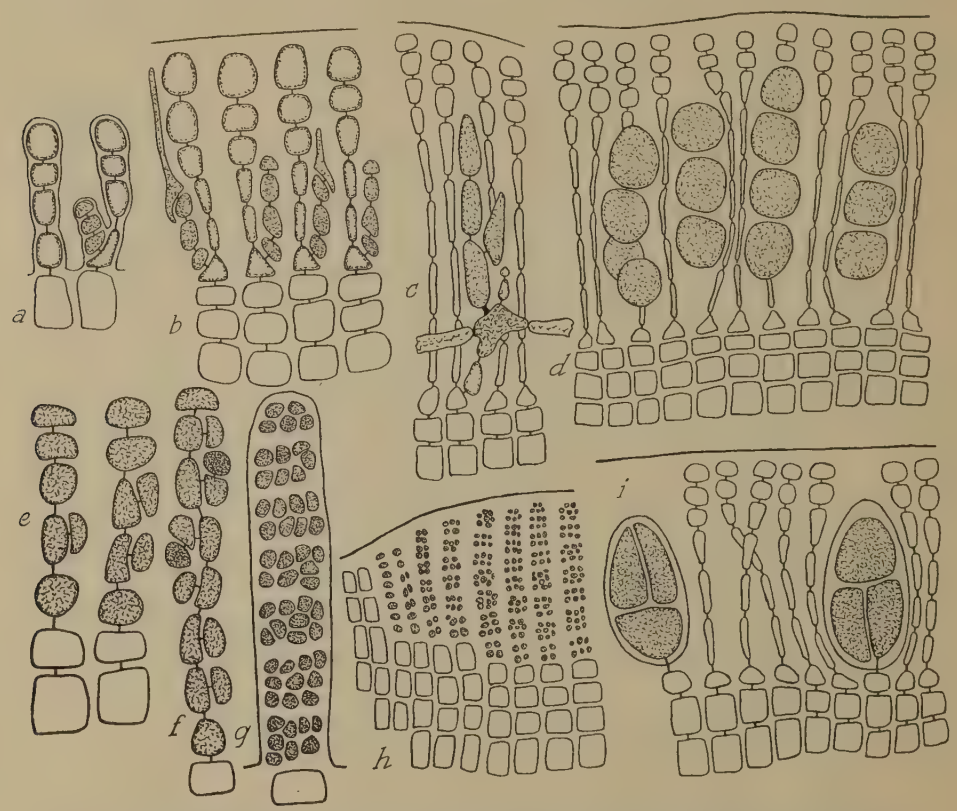

Fig. 13. *Peyssonnelia pacifica*. *a—d* development of the carpogonial branches, the auxiliary cell branches and the gonimoblasts; *e—h* development of the spermatangia; *i* tetrasporangia. — *a—b* × 700; *c—d* × 520; *e—g* × 950; *h—i* × 520.

hard to do a positive determination; for that reason I think it better to mention my plant under a new name.

30—40 μ longae et 20—30 μ crassae; cellulae inferiores filamentorum erectorum (perithalli) 20—30 μ longae et 15—18 μ latae; cellulae superficiales 4—6 μ longae et latae; nemathecia mascula c:a 50 μ, nemathecia feminea c:a 100 μ et nemathecia tetrasporifera c:a 75 μ crassa; paranemata simplicia, claviformia, e 5—8 cellulis constituta; carposporae diametro c:a 15 μ; tetrasporangia 45—55 μ longa et 25—30 μ crassa, cruciatim divisa.

Of the new species *Peyssonnelia pacifica* I have found as well male as female and tetrasporic specimens. In fig. 13 I have given some drawings, and I hope that they will show the development of the reproductive organs. The development of the spermatangia takes place in the same way as in *Polyides rotundus* (Kylin 1923 p. 19). The carpogonial branches and the auxiliary cell branches are cut off from the lowest cell of the nemathecial filaments (the paraphysis), and consist of four cells. After the fertilization the carpogonium joins the second cell of the carpogonial branch, and then this cell gives off sporogenous filaments. These filaments join the auxiliary cell branches, generally the second cell of the branches. Thus this cell represents the auxiliary cell. The fig. 13 *c* shows the development of the gonimoblast. Each gonimoblast generally consists of 3—4 carpospores. — The male and female nemathecia occur on different individuals. The tetrasporangia are terminal on short nemathecial filaments consisting of only a tetrasporangium and a stalk cell.

In Tilden Americ. Alg. No. 201 there is a plant named *Peyssonnelia Dubyi*. Setchell and Gardner (1903 p. 367) say, that it is *Hildenbrandtia prototypus*. The specimen is sterile, and thus can not be named with certainty; in my opinion the plant is not to be referred to *Hildenbrandtia*.

Hildenbrandtia Narbo (1834).

1) Frond of a dark purplish red colour, about 1—2 mm thick ..... *H. occidentalis*.
2) Frond of a rose-red colour, about 100—300 μ thick ..... *H. rosea*.

Hildenbrandtia occidentalis Setch. (1817) in Univ. Calif. Publ. Bot. Vol. 6 p. 393. — Type specimens from California.

San Juan Island, south of False Bay; on stones in the litoral zone; not fruiting.

Setchell and Gardner (1903 p. 367) say that *Hildenbrandtia prototypus* occurs on the west coast of Whidbey Island. I think it is better to refer the specimens from Whidbey Island to *H. occidentalis* than to the Mediterranean species *H. prototypus*.

Hildenbrandtia rosea Kütz. (1843) Phycol. Gen. p. 384; Tab. Phyc. 19 pl. 91. — Type specimens from the North Sea.

San Juan Island, south of False Bay; Brown Island; Canoe Island; Peavine Pass; on stones in the litoral and sublitoral zones; not seen with fruits.

Fam. **Corallinaceae.**

Gigartinales.

Fam. Gigartinaceae.

Endocladia J. Ag. (1841).

Endocladia muricata (Post. et Rupr.) J. Ag. Alg. Liebm. p. 10; Sp. Alg. 2 p. 237; *Gigartina muricata* Post. et Rupr. (1840) Illustr. Alg. p. 16; *Endocladia muricata* Harv. Ner. Bor. Amer. 2 p. 182 pl. 27 B; *Endocladia (Acanthocladia) hamulosa* (Rupr.) J. Ag. Bidr. Florid. Syst. p. 32. — Type specimens from Alaska.

Very common on rocks and stones in the upper part of the litoral zone; with cystocarps and tetraspores.

Setchell and Gardner (1903 p. 297) describe two different forms of this species from Friday Harbor, viz. *f. compressa* and *f. inermis*. The first one is distributed in Phycoth. Bor. Amer. Fasc. 22 No. 1089; it comes very near the form described by Harvey (l. c.) from the Californian coast. The second one is distributed in Phycoth. Bor. Amer. Fasc. 22 No. 1090; this is a dwarf form almost or quite without spines. It is this form, which is described by Postels and Ruprecht (l. c.) under the name of *Gigartina muricata;* I have seen some of the type specimens in J. Agardh's herbarium. The form is very common near Friday Harbor where it grows in small tidepools at highwater mark. I have also seen the type specimens of *Endocladia hamulosa* J. Ag. from Vancouver Island in J. Agardh's herbarium. This species is identical with the Californian form of *Endocladia muricata.*

Iridaea Bory (1826)

1) Frond cordate, not much lobed; cystocarps about 1—1,5 mm broad ..... *I. cordata.*
2) Frond much lobed, irregular, more cartilaginous than the former; cystocarps about 2—3 mm broad ..... *I. heterocarpa.*

Iridaea cordata (Turn.) J. Ag. Sp. Alg. 2 p. 254; *Fucus cordatus* Turn. (1809) Hist. Fuc. 2 pl. 116; *Iridaea laminarioides* Tilden Amer. Alg. No. 328 a. — Type specimens from the west coast of North America (the Island Banks).

Common on rocks in the upper sublitoral zone; with cystocarps and tetraspores.

Iridaea heterocarpa Post. et Rupr. (1840) Illustr. Alg. p. 18; *Iridaea laminarioides* Tilden Amer. Alg. No. 328 b. — Type specimens from the North Pacific Ocean.

Common on rocks in the upper part of the sublitoral zone; with cystocarps and tetraspores.

Rhodoglossum J. Ag. (1876).

Rhodoglossum latissimum J. Ag. (1876) Epicr. p. 187. — Type specimens from New Zealand and Auckland Islands.

San Juan Island (Muenscher 1915 p. 79); west coast of Whidbey Island (Setchell and Gardner 1903 p. 300).

Gigartina Stackh. (1809).

1) Frond about 10 cm high, laciniate, more or less branched ..... *G. papillata.*
2) Frond about 20—40 cm high, ovate to lanceolate, not very laciniate.. *G. exasperata.*

Gigartina papillata (Ag.) J. Ag. Sp. Alg. 2 p. 274; *Sphaerococcus papillatus* Ag. (1821) Icon. Alg. ined. pl. 19. — Type specimens from Hawaiian Islands [1].

f. vulgaris (Harv.) Kylin nov. comb.; *Gigartina mamillosa* α *vulgaris* Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 172.

f. latissima (Harv.) Kylin nov. comb.; *Gigartina mamillosa* β *latissima* Harv. (1862) l. c.; *Gigartina papillata f. cristata* Setch. in Collins, Holden and Setchell P. B. A. No. 426.

On rocks in the litoral zone; common; fruiting.

I think *Gigartina papillata* from the Pacific Ocean and *G. mamillosa* from the Atlantic Ocean ought to be distinguished as two different species. They are both very variable and certainly nearly related to each other; in my opinion they represent two parallel species.

The form *vulgaris* is smaller and more branched than the form *latissima; f. vulgaris* grows near the high tide line, *f. latissima* is best developed about half way between tide marks. I have seen a type specimen of *G. mamillosa* β *latissima* Harv. in J. Agardh's herbarium, and it shows with certainty that Harvey's form is identical with *G. papillata f. cristata* Setch.

Gigartina exasperata Harv. et Bail. (1851) in U. S. Expl. Exped. p. 371; Harv. Ner. Bor. Amer. 2 p. 177; *Gigartina spinosa* Tilden Amer. Alg. No. 327. — Type specimens from Puget Sound.

Canoe Island, Peavine Pass; dredged in a depth of 5—10 fathoms; fruiting.

This species is related to *Gigartina radula*, and by Setchell and Gardner (1903 p. 303) considered to be only a form of the same; in my opinion, however, this is not correct. Setchell and Gardner report *G. radula f. typica* and *G. radula f. microphylla* from the west coast of Whidbey Island. I think that these two forms ought to be distinguished from each other as two different species.

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[1] The type specimens were collected by Chamisso. Setchell and Gardner (1903 p. 302) say that »Chamisso labelled the plant as coming from Oahu, one of the Hawaiian Islands, but as Ruprecht remarks, it probably came from Unalaska.» This is not correctly cited. Ruprecht says (1850 p. 318): »Chamisso bezweifelte selbst, dass er seinen *S. papillatus* aus Owahu und *Corallopsis dichotoma* aus Unalaschka mitbrachte, wie ich jetzt sehe. Ich halte Ross in Californien, woher ich ganz ähnliche neuere Exemplare sah, für das Vaterland der ersteren Art; *Corallopsis* stammt eher aus tropischen Gegenden.»

Stenogramma Harv. (1841).

Stenogramma californica Harv. (1841) in Bot. Beechey p. 408; *St. interrupta* Harv. Ner. Bor. Amer. 2 p. 163 pl. 19. — Type specimens from San Francisco, California.

Canoe Island, Peavine Pass; dredged in a depth of 5—10 fathoms; with tetraspores and young cystocarps.

The frond of the European *Stenogramma interrupta* is 5—10 mm broad, the frond of the American *St. californica* on the other hand 10—20 mm broad. The American species is more rigid in substance and darker in colour than the European one, as already has been pointed out by Harvey (1853 p. 163).

Ahnfeltia Fries (1835).

1) Branches about 0,5 mm thick ..... *A. plicata.*
2) Branches about 1,5 mm thick..... *A. concinna.*

Ahnfeltia plicata (Huds.) Fr. Fl. Scan. p. 310; J. Ag. Sp. Alg. 2 p. 311; *Fucus plicatus* Huds. (1762) Fl. Angl. p. 470. — Type specimens from England.

San Juan Island (Muenscher 1915 p. 78); west coast of Whidbey Island (Setchell and Gardner 1903 p. 305).

Ahnfeltia concinna J. Ag. (1847) Alg. Liebm. p. 12; Sp. Alg. 2 p. 312. — Type specimens from Hawaiian Islands.

San Juan Island (Muenscher 1915 p. 78); west coast of Whidbey Island (Setchell and Gardner 1903 p. 305.)

Pugetia Kylin nov. gen.

Frond from a short stipe, membranous, blade-like, orbicular, with a broadly and irregularly laciniate margin; cortical layer consisting of one row of assimilating cells; medullary layer consisting of two rows of big cells and between these some bundles of small assimilating cells; systocarps densely scattered over the frond, immersed in the medullary layer; tetrasporangia densely scattered over the frond with cruciate tetraspores [1].

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[1] *Pugetia* Kylin nov. gen. Gigartinacearum. — Frons breve stipitata, plana, foliacea, orbiculariter expansa, margine leviter laciniata; stratum corticale e una serie cellularum assimilantium constitutum; stratum medullare e duabus seriebus cellularum majorum, inter quas cellulas minores assimilantes vidimus, compositum; cystocarpia per frondem dense dissipata, in strato medullari immersa; tetrasporangia sparsa, in strato corticali parum mutato immersa, cruciatim divisa.

Pugetia fragilissima Kylin nov. sp. — Frons diam. usque ad 20 cm lata, 200 μ crassa, fragilissima; cystocarpia diam. 300—500 μ.

Pugetia fragilissima Kylin nov. sp.

Frond up to 20 cm in diameter, 200 μ thick, very fragile; cystocarps 300—500 μ in diameter.

Canoe Island, Peavine Pass; dredged in a depth of 5—10 fathoms; with cystocarps and tetraspores.

The new genus *Pugetia* is most nearly related to *Callophyllis*, but differs from this genus in the anatomical construction of the frond. In *Pugetia* there are small bundles of assimilating filaments between the big cells of the medullary layer; the cells in these filaments are nearly isodiametric. In *Callophyllis* there are also filaments between the big cells of the medullary layer, but they consist of a little more elongated cells, which do not have any special function as assimilating ones. The fig. 14 *a—b* shows the development of the procarp and the gonimoblast. I

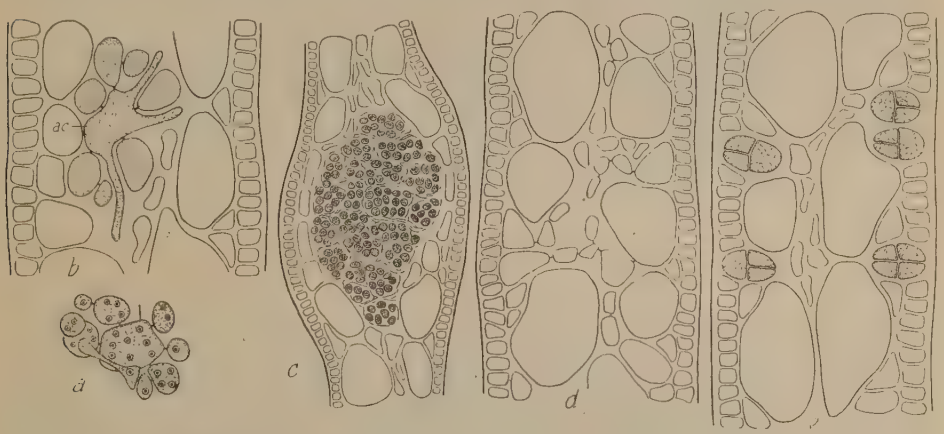

Fig. 14. *Pugetia fragilissima*. *a* unfertilized procarp; *b* sporogenous filaments growing out from the auxiliary cell (*ac*); *c* cystocarp in cross section; *d* cross section through the frond; *e* tetrasporangia. — *a—b* × 600; *c* × 175; *d—e* × 400.

think that the development comes very near that one in *Callophyllis*. The structure of the mature gonimoblast is the same as in *Callophyllis*. — It is a remarkable fact, that the auxiliary cell has many nuclei (fig. 14 *a*).

Callophyllis Kütz. (1843).

1) Frond up to 10 cm high, richly branched; branches 2—5 (—8) mm broad, about 200 μ thick; ultimate lobes acuminate; cystocarps subterminal, immersed in the ultimate lobes ..... *C. flabellulata.*
2) Frond up to 10 cm high, richly branched; branches 8—15 (—20) mm broad, under 200 μ thick; ultimate lobes obtuse; cystocarps 0,25—0,75 μ broad, acuminate, scattered over the frond ..... *C. heanophylla.*
3) Frond up to 20 cm high, 3—5 times dichotomously flabellate, ultimate lobes 5—15 mm broad, rotundate; margin of the frond finely crisped; cystocarps crowded just within the margin ..... *C. Thompsonii.*

Fig. 15. *Callophyllis flabellulata.* HARVEY's type specimens in J. AGARDH's herbarium. — $^{7}/_{8}$ nat. size.

Fig. 16. *Callophyllis flabellulata* — $^{7}/_{10}$ nat. size.

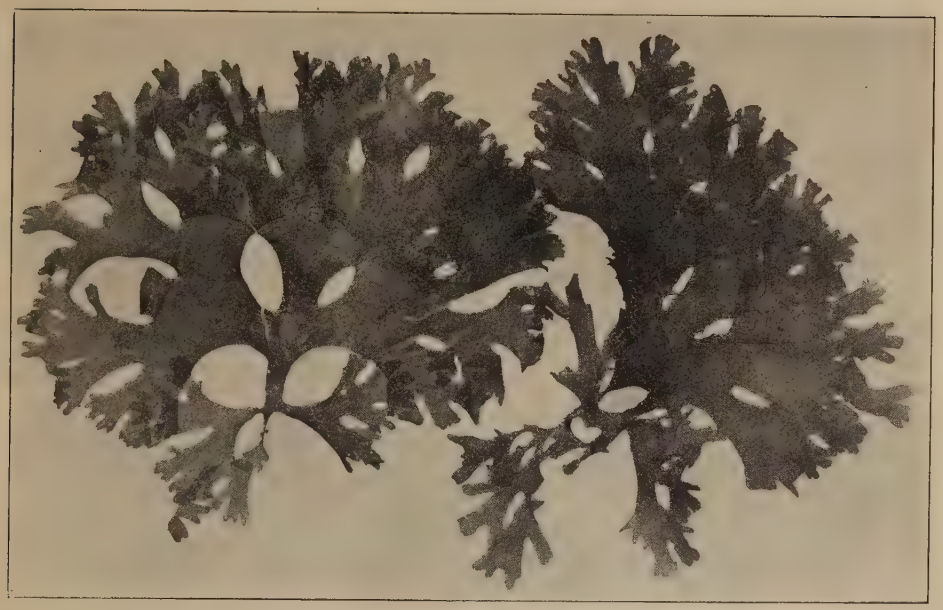

Fig. 17. *Callophyllis heanophylla.* — $^{7}/_{10}$ nat. size.

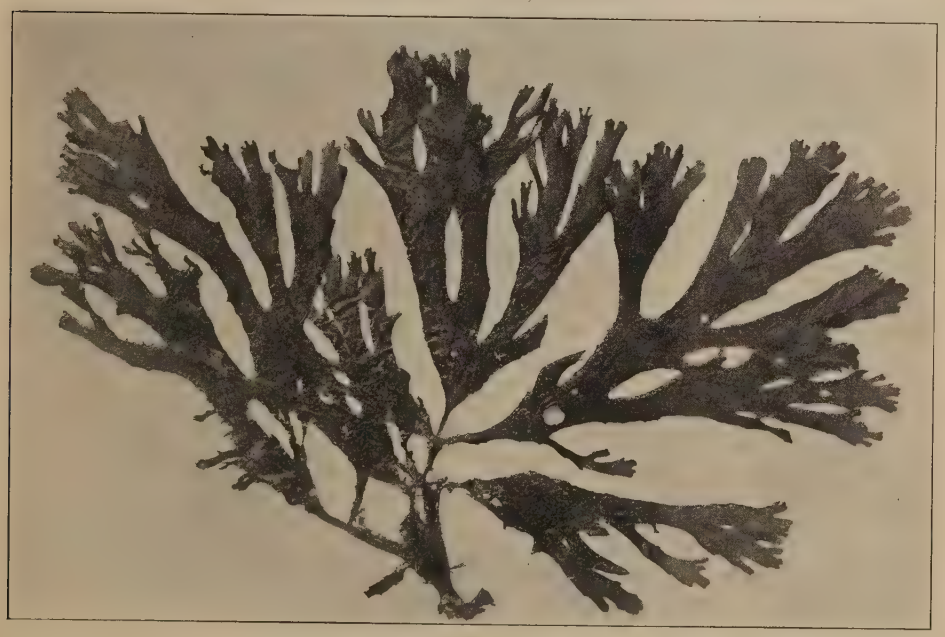

Fig. 18. *Callophyllis edentata.* — $^{7}/_{10}$ nat. size.

4) Frond up to 20 cm high, furcate to flabellate; superior lobes 15—30 mm broad; margin of the frond undulate to crispate, irregularly dentate; cystocarps up to 1 mm broad, scattered over the frond ..... *C. crenulata.*

5) Frond up to 20 cm high, 3—5 times furcate to flabellate; branches 8—15 mm broad, ultimate lobes small, roundish to obtuse; margin of the frond smooth, sometimes finely crisped, not dentate; cystocarps up to 1 mm broad, acuminate on one side, scattered over the frond ..... *C. edentata.*

Callophyllis flabellulata Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 171. — Type specimens from Vancouver Island (Esquimalt).

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, Shaw Island; dredged in a depth of 5—10 fathoms; not fruiting.

In fig. 15 I give a picture of Harvey's type specimens in J. Agardh's herbarium. This form is common in the vicinity of Friday Harbor. I also give a picture (fig. 16) of a form with somewhat broader branches; this one is also pretty common. Between the broad and the narrow forms there are many intermediate ones, and on a specimen of the broad form it may turn up some bundles with narrow branches. The ultimate lobes are always acuminate.

Callophyllis heanophylla Seth. (1923) in Univ. Calif. Publ. Bot. Vol. 10 p. 401. — Type specimens from Shaw Island, Wash.

Canoe Island; common; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Callophyllis Thompsonii Setch. (1923) in Univ. Calif. Publ. Bot. Vol. 10 p. 399. — Type specimens from Canoe Island, San Juan County. Wash.

Canoe Island (Setchell l. c.).

Callophyllis crenulata Setch. (1923) in Univ. Calif. Publ. Bot. Vol. 10 p. 400. — Type specimens from Whidbey Island, Wash.

Whidbey Island (Setchell l. c.).

Callophyllis edentata Kylin nov. sp.

Frond up to 20 cm high, 4—6 times furcate to flabellate; branches 8—15 mm broad, 400—500 μ thick; ultimate lobes small, roundish to obtuse; margin of the frond smooth, sometimes finely crisped, not dentate; cystocarps up to 1 mm broad, acuminate on one side, scattered over the frond; tetrasporangia scattered, immersed in the cortical layer [1].

Turn Island; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

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[1] *Callophyllis edentata* Kylin nov. sp. — Frons usque ad 20 cm alta, 3—5-plo dichotomo-flabellata; rami 8—15 mm lati, 400—500 μ crassi; lobi ultimi parvi, rotundati vel obtusati; margo frondis plana vel leviter crispata, edentata; cystocarpia usque ad 1 mm lata, apiculata, per frondem sparsa; tetrasporangia sparsa, in strato corticali immersa.

Callocolax Schmitz (1894).

Callocolax fungiformis Kylin nov. sp.

Frond 4—6 mm high, 4—5 mm in diameter, fungiformed with a short stipe[1].

Turn Island; parasitic on *Callophyllis edentata*, dredged at a depth of 5—10 fathoms; not fruiting.

Hitherto only one *Callocolax* species is described, viz. *C. neglectus* from the European coasts of the Atlantic Sea. The new species, *C. fungiformis*, is throughout much bigger than the old one.

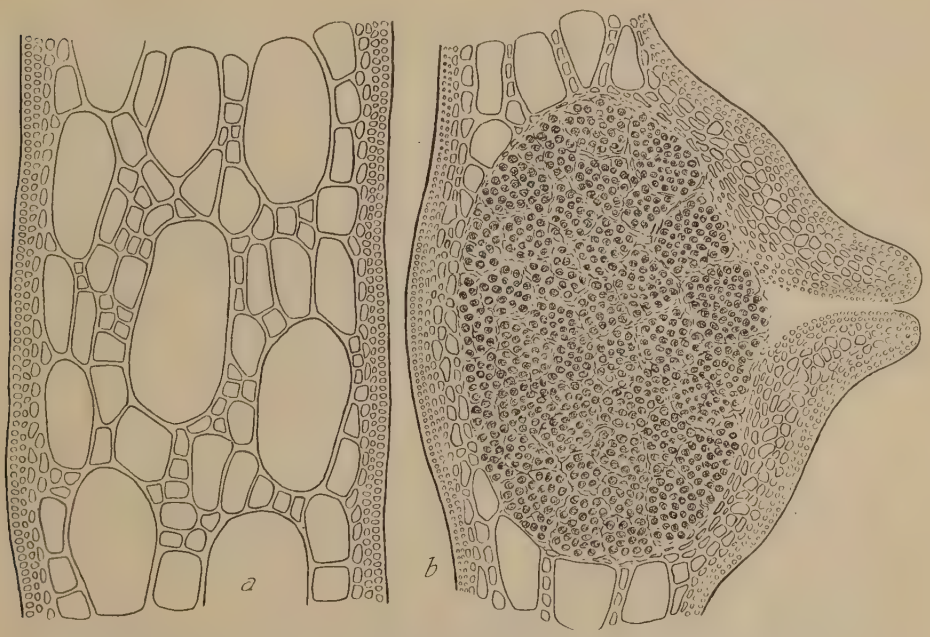

Fig. 19. *Callophyllis edentata*. *a* cross section through the frond; *b* cross section through the cystocarp. — *a* × 140; *b* × 65.

Callymenia J. Ag. (1842).

Callymenia oblongifructa Setch. in Univ. Calif. Publ. Bot. Vol. 4 p. 234; *Iridaea oblongifructa* Setch. (1901) in Zoe Vol. 5 p. 123. — Type specimens from Whidbey Island, Wash.

Whidbey Island and San Juan Island (Setchell 1912 p. 236).

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[1] *Callocolax fungiformis* Kylin nov. sp. — Frons 4—6 mm alta, diam. 4—5 mm, fungiformis, breviter stipitata; cystocarpia et tetrasporangia ignota.

Fam. **Rhodophyllidaceae.**

Agardhiella Schmitz (1889).

Agardhiella Coulteri (Harv.) Setch. in Collins, Holden and Setchell P. B. A. No. 333; *Hypnea Coulteri* Harv. (1851) in U. S. Expl. Exped. p. 371; *Rhabdonia Coulteri* Harv. Ner. Bor. Amer. 2 p. 154 pl. 23; Tilden Amer. Alg. No. 217; *Agardhiella tenera* Setch. et Gardn. Alg. Northwest. Amer. p. 309. — Type specimens from Monterey, California.

Canoe Island; dredged at a depth of 5—10 fathoms; with cystocarps and tetrasporangia.

Setchell and Gardner (1903 p. 309) say that »there seems to be no difference between the species of the eastern and the western coasts» and consequently they assign *Agardhiella Coulteri* to *A. tenera*. It is true that these two species are nearly related to each other, but in my opinion they ought to be considered as two different ones.

Schmitz (1889) has referred the genus *Agardhiella* to the family Rhodophyllidaceae. According to the investigations of Osterhout (1896 p. 403) and Børgesen (1918 p. 361) there is, however, no special procarps in *Agardhiella*. After the fertilization the carpogon forms a long sporogenous filament in the same way as in many Cryptonemiacees, and among these *Agardhiella* seems to be most nearly related to the family Nemastomaceae, specially to such types as *Furcellaria*.

Anatheca Schmitz (1896).

Anatheca furcata Setch. et Gardn. (1903) Alg. Northwest. Amer. p. 310 pl. 23—24; Collins, Holden and Setchell P. B. A. No. 932. — Type specimens from Whidbey Island, Wash.

Canoe Island, Peavine Pass; dredged at a depth of 5—10 fathoms, with cystocarps and tetraspores.

In the growing point of *Anatheca furcata* there is a bundle of filaments, each with an apical cell cutting of segment cells by oblique cellwalls; fig. 20 *a—b* shows the cell divisions. — The carpogonial branches consist of three (rarely two or four) cells. They arise from the inner side of the cells in the cortical layer very close to the growing tip of the frond. Generally they are slightly bent downwards. The trichogyne recurves abruptly, so that the tip is directed towards the surface of the frond (fig. 20 *c*). There is only one carpogonial branch from each supporting cell, which does not in any respect differ from the surrounding vegetative ones. — As auxiliary cells serve some cells in the cortical layer of the frond. Certain cells begin very early to have a different appearence from the ordinary ones. They become more densely filled with protoplasm, but remain uninuclear; later on they grow somewhat constricted in the middle. The auxiliary cell always bears three

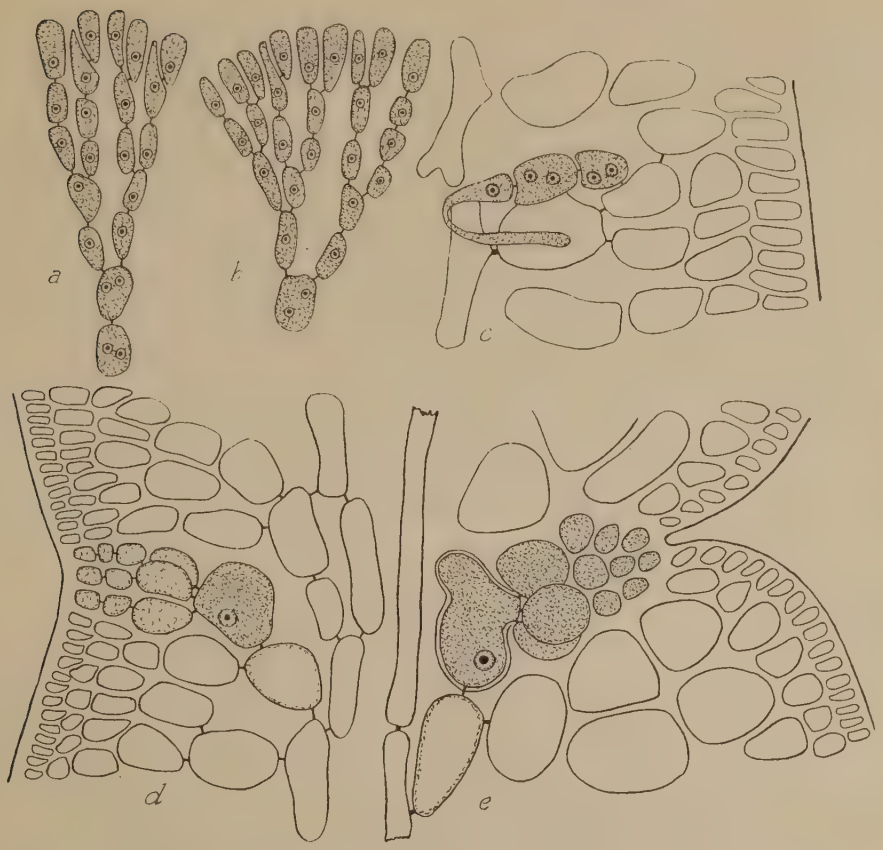

Fig. 20. *Anatheca furcata.* *a—b* filaments in the growing point; *c* carpogonial branch; *d—e* auxiliary cells. — *a—b* × 700; *c—d* × 600; *e* × 380.

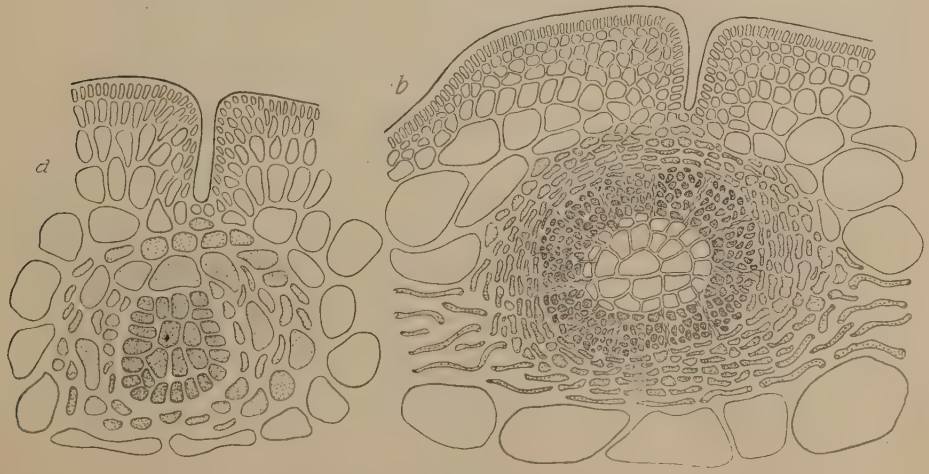

Fig. 21. *Anatheca furcata.* Young cystocarps. — *a* × 280; *b* × 150.

large cells with a dense content, and they in their turn a different number of small ones which also have a dense content. The cell to which the auxiliary one is attached rests on one of the elongated cells of the medullary layer; it generally has a somewhat denser content than the surrounding vegetative cells, but never so dense as the auxiliary cell itself. — The number of auxiliary cells is very small compared with the number of carpogonial branches, only about one per cent.

I have not seen any conjugating tubes between the carpogons and the auxiliary cells, but I think they will be formed in the same way as in *Agardhiella* (*Rhabdonia;* Osterhout 1896 p. 415; Børgesen 1919 p. 364). After conjugation the auxiliary cell cuts off a segment by an oblique wall near the top and on its inner side. The cell thus cut off divides and gives rise to a mass of comparatively small cells densely filled with protoplasm (fig. 21 *a*). By repeated divisions the mass enlarges and finally we find in the middle of the gonimoblast a number of large but rather empty cells and around them short, branched filaments of small cells, densely filled with protoplasm; these cells become carpospores. — After the conjugation between the sporogenous filament from the carpogon and the auxiliary cell, the sterile cells around the auxiliary one give off filaments which divide very irregularly and soon become filled with a dense content. These filaments form a nutritive tissue around the gonimoblast. A number of cells from the gonimoblast grows out into sterile filaments, reaches the nutritive tissue and attaches themselves to it, forming connections by means of secondary pits with the cells of its innermost layer, in the same way as Osterhout (1896 p. 416) describes in *Agardhiella (Rhabdonia).*

Anatheca is related to *Agardhiella* and *Rhabdonia.* All these algae are considered to belong to the family Rhodophyllidaceae. Concerning the procarps there is, however, a great difference between the first mentioned algae and such types of the family as *Rhodophyllis* and *Cystoclonium.* In the latter, but not in the former, there are real procarps, that is, the carpogons and the auxiliary cells are produced in pairs (Kylin 1923 p. 25 and p. 32); this fact is very important, and in my opinion it points out that the old family Rhodophyllidaceae should be divided into two new ones. To the family Rhodophyllidaceae in a limited sense has to be referred only the species with procarps; the species without procarps ought to be referred to a new family for which I propose the name Rhabdoniaceae. To this family belong, except *Rhabdonia, Agardhiella* and *Anatheca,* the genera *Flahaultia* and *Solieria;* and to the family Rhodophyllidaceae, except *Rhodophyllis* and *Cystoclonium,* the genus *Euthora.* As to the other genera of the old family Rhodophyllidaceae it is for the moment not possible to tell with certainty to which family they really belong.

The family Rhabdoniaceae shows relationship to Nemastomaceae, especially to the genus *Furcellaria.* In both families there are carpogonial branches without connection to any special auxiliary cells, that is, there are no procarps; and, furthermore, in both of them the auxiliary cells are cells corresponding to vegetative ones in the frond. For the present Nemastomaceae is referred to the order Cryptonemiales. As to the development of the auxiliary cells there is, however, in this order

two very different types. In all the families, except Nemastomaceae, the auxiliary cell is developed in a special branch, an auxiliary cell branch, which is very much alike the carpogonial branch, but in Nemastomaceae the auxiliary cell corresponds with a cell in the vegetative system of the frond. In my opinion, this fact shows that Nemastomaceae is not so very nearly related to the other Cryptonemiales, but ought to be separated from them as a new order, for which I propose the name Nemastomales. To this new order should be referred the families Nemastomaceae, Rhabdoniaceae and Rhodophyllidaceae. I do not believe, there is any near relationship between the families Rhodophyllidaceae and Gigartinaceae, which for the present, however, are grouped together in the order Gigartinales.

Euthora J. Ag. (1847).

Euthora fruticulosa (Rupr.) J. Ag. Sp. Alg. 2 p. 705; *Nereidea fruticulosa* Rupr. (1850) Alg. Ochot. p. 255. — Type specimens from the Ochotsk Sea.

Canoe Island, Peavine Pass; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Rhodymeniales.

Fam. Sphaerococcaceae.

Gracilaria Grev. (1830).

Gracilaria confervoides (L) Grev. Alg. Brit. p. 123; Harv. Phyc. Brit. pl. 65; Tilden Amer. Alg. No. 215; *Fucus confervoides* L. (1763) Sp. Plant. 2 p. 1668. — Type specimens from the European coasts of the Atlantic Sea.

San Juan Island, south of False Bay; Canoe Island; in the sublitoral zone; with cystocarps and tetraspores.

Fam. Rhodymeniaceae.

Fauchea Bory et Mont. (1846).

Fauchea Fryeana Setch. (1912) in Univ. Calif. Publ. Bot. Vol. 4 p. 239; *Fauchea laciniata* Setch. et Gardn. Alg. Northwest Amer. p. 313 pl. 25. — Type specimens from Friday Harbor, Wash.

Canoe Island; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Rhodymenia Grev. (1830).

1) Tetrasporangia in small irregular sori, sometimes forming irregular lines on the surface of the dichotomously branched frond ..... *Rh. Gardneri.*

2) Tetrasporangia scattered over the surface, not grouped together in sori.
   a) Frond simple or branched from the stipe, without prolifications from the margin; blade undivided or with a few, irregular, broad lobes.

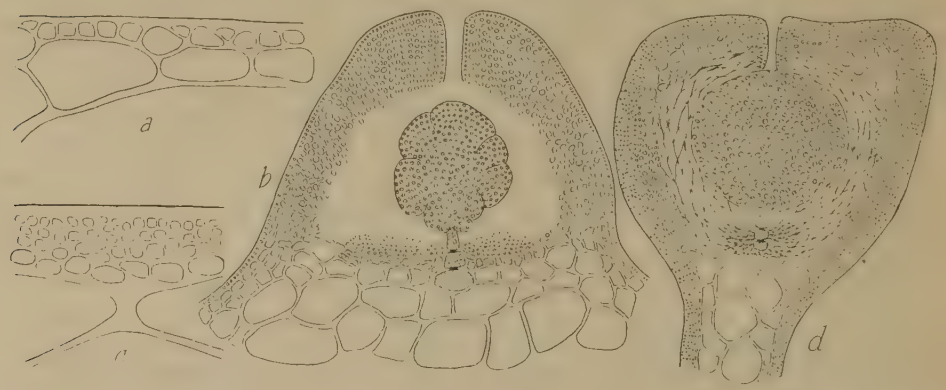

Fig. 22. *a* -*b* *Rhodymenia Gardneri*; *c*—*d* *Fauchea Fryeana* — *a* × 350; *b* × 60; *c* × 350; *d* × 40.

Fig. 23. *Rhodymenia stipitata.* — 1/2 nat. size.

*) Frond up to 60 cm high, perforated, 150—200 μ thick ..... *Rh. pertusa.*
**) Frond up to 25 cm high, not perforated, 250—300 μ thick ..... *Rh. stipitata.*

b) Frond irregularly, dichotomously branched with broad lobes; prolifications from the margin ..... *Rh. palmata.*

Rhodymenia Gardneri (Setch.) Kylin nov. comb; *Fauchea Gardneri* Setch. (1901) in Zoe Vol. 5 p. 125; Setch. et Gardn. Alg. Northwest. Amer. p. 313 pl. 19; Collins, Holden and Setchell P. B. A. No. 933. — Type specimens from Whidbey Island, Wash.

Canoe Island; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

This species is not to be referred to the genus *Fauchea* but to *Rhodymenia*, at least for the present. Fig. 22 shows the differences between *Fauchea* and *Rhodymenia* concerning the cortical layers and the cystocarps.

Rhodymenia pertusa (Post. et Rupr.) J. Ag. Sp. Alg. 2 p. 376; *Phorphyra pertusa* Post. et Rupr. (1840) Illustr. Alg. p. 20 pl. 36. — Type specimens from Kamtshatka.

Canoe Island; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Rhodymenia stipitata Kylin nov. sp.

Frond 15—25 cm high and 3—8 cm broad, with a 2—4 cm long stipe, simple or branched from the stipe; blade with a cuneate base, generally undivided, sometimes with a few, irregular, broad lobes, not perforated, 250—300 μ thick; cystocarps rather sparsely scattered over both surfaces of the frond, about 1,5 mm broad, prominent on one surface; tetrasporangia scattered in the cortical layer with cruciate tetraspores [1].

San Juan Island, on the piles of Friday Harbor's docks; with cystocarps and tetraspores.

This species is nearly related to *Rhodymenia pertusa*, but it differs from the last-mentioned in having a thicker (cfr. the key), not perforated blade. The cystocarps are somewhat larger, but not so densely scattered in *Rh. stipitata* as in *Rh. pertusa.*

Rhodymenia palmata (L.) Grev. Alg. Brit. p. 93; *Fucus palmatus* L. (1763) Sp. Plant. 2 p. 1630. — Type specimens from the European coasts of the Atlantic Sea.

f. mollis Setch. et Gardn. (1903) Alg. Northwest. Amer. p. 315; Collins, Holden and Setchell P. B. A. No. 934; *Grateloupia Cutleriae* Tilden Amer. Alg. No. 304. — Type specimens from the northwestern coast of America.

San Juan Island, south of False Bay; on rocks, forming a zone at low-water mark; with tetraspores.

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[1] *Rhodymenia stipitata* Kylin nov. sp. — Frons 15—25 cm alta, 3—8 cm lata, 2—4 cm longe stipitata, simpliciuscula vel e stipite ramosa; frons e stipite cuneatim dilatata, simpliciuscula vel irregulariter late laciniata, non perforata, 250—300 μ crassa; cystocarpia per frondem laxe sparsa, basi c:a 1,5 mm lata, supra unam paginam elevata; tetrasporangia cruciatim divisa, in strato corticali sparsa.

Chrysymenia J. Ag. (1842).

Chrysymenia pseudodichotoma Farl. (1889) in Bull. Torr. Bot. Club Vol. 16 p. 1 pl. 88. — Type specimens from California.

Turn Island, Peavine Pass; dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

My largest specimens are only 6 cm high. Farlow says, the species is 10—20 cm high. Except for the length of the frond, my specimens agree in all respects with the description and the figure, given by Farlow.

Chylocladia Grev. (1833).

Chylocladia ovalis (Huds.) Hook. Brit. Fl. 2 p. 297; *Fucus ovalis* Huds. (1778) Fl. Angl. p. 573. — Type specimens from England.

f. subarticulata (Turn.) Kylin nov. comb.; *Fucus ovalis* γ *subarticulata* Turn. (1809) Hist. Fuc. 2 pl. 81 h; *Lomentaria ovalis* γ *subarticulata* Harv. Ner. Bor. Amer. 2 p. 78; *L. ovalis var. Coulteri* Tilden Amer. Alg. No. 214. — Type specimens from the south coast of England and from Nootka Sound, B. C.

East Sound, Orcas Island (Setchell and Gardner 1903 p. 316).

Plocamium Lamour. (1819).

1) Frond deep red, 10—20 cm high ..... *Pl. pacificum.*
2) Frond violet, 2—3 cm high..... *Pl. tenue.*

Plocamium pacificum Kylin nov. sp.; *Plocamium coccineum* Harv. Ner. Bor. Amer. 2 p. 153; Setch. and Gardn. Alg. Northwest. Amer. p. 317; Collins, Holden and Setchell P. B. A. No. 994.

Frond deep red, cartilaginous, 10—20 cm high, richly branched, with narrow, below somewhat compressed, above flat branches; ramuli alternately ternate or quaternate, the lowest of each series subulate, quite entire; cystocarps in the margin, solitary, sessile; spore leaves on the inner faces of the pectinate ramuli, divaricately, richly branched [1].

San Juan Island, south of False Bay, in the upper part of the sublitoral zone; with tetraspores.

In my opinion the form of *Plocamium coccineum* from the west coast of North America is quite different from the Atlantic form and is to be considered as a

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[1] *Plocamium pacificum* Kylin nov. sp. — Frons coccinea, cartilaginea, 10—20 cm alta, ramosissima, anguste linearis, inferne paulo compressa, superne complanata; rami ramulis ternis quaternisve secundis alterne ornati; ramuli alternantes inferiores a basi latiore attenuati, subulati, integerrimi; cystocarpia in margine frondis sessilia, solitaria; sporophylla e pinnulis transformatis orta, divaricate ramosissima.

distinct species. Already Harvey (1853 p. 153) has pointed out that the Californian specimens are more robust, more cartilaginous and less compressed than other specimens, and J. Agardh (1876 p. 340) says that the spore leaves of the Californian form are much more branched than those of the European one.

Plocamium tenue Kylin nov. sp.

Frond violet, 2—3 cm high, richly branched, with narrow (less than 0,5 mm broad), flat branches; ramuli alternately ternate or quaternate the lowest of each series quite entire, 2—3 mm long with a round tip not subfoliaceous; spore leaves furcate in the top [1].

Fig. 24 *a Plocamium coccineum* with sporophylls (from Plymouth, England); *b Plocamium pacificum* sporophylls (from La Jolla, Calif); *c—d Plocamium tenue.* — *a—c* × 35; *d* × 10.

Brown Island; San Juan Island, south of False Bay; on stones in the litoral zone; with tetraspores.

This new species is most nearly related to *Pl. violaceum*, and could perhaps be considered as a small form of this one. It is in all respects smaller than *Pl. violaceum*. Particularly should it, however, be pointed out that the lowest of the 3—4 alternate ramuli is rather small, and not at all subfoliaceous.

Halosaccion Kütz. (1843).

Halosaccion glandiforme (Gmel.) Rupr. Alg. Ochot. p. 279. pl. 16; *Ulva glandiformis* Gmel. (1768) Hist. Fuc. p. 232; *Dumontia hydrophora* Post. et Rupr.

[1] *Plocamium tenue* Kylin nov. sp. — Frons violacea, 2—3 cm alta, ramosissima, anguste linearis, complanata; rami < 0,5 mm lati, ramuli ternis quaternisve secundis alterne ornati; ramuli alternantes inferiores integerrimi, apice rotundati, 2—3 mm longi, non subfoliacei; sporophylla a pinnulis transformatis orta, apice bifurcata.

Illustr. Alg. p. 19 pl. 35 c; *Halosaccion hydrophora* J. Ag. Sp. Alg. 2 p. 358; *Adenocystis Lessonii* Tilden Amer. Alg. No. 242. — Type specimes from the Ochotsk Sea.

Brown Island; San Juan Island near the new marine station; on rocks in the litoral zone; with tetraspores.

Ceramiales.

Fam. Ceramiaceae.

Trailliella Batt. (1896).

Trailliella intricata Batt. (1896) in Journ. of Bot. Vol. 36. p. 10. — Type specimens from England.

San Juan Island, on the piles of Friday Harbor's docks.

My specimens agree very well with specimens from England.

Rhodochorton Näg. (1861).

1) Basal layer consisting of creeping filaments; plant growing on rocks at high-water mark ..... *Rh. tenue.*
2) Basal layer consisting of a cellular disk; tetrasporangia terminal on short lateral branches, or on the erect filaments; plant growing on different algae or on *Sertularia* in the sublitoral zone ..... *Rh. penicilliforme.*
3) Plant forming prostrate filaments in the cortex of red algae *(Grateloupia);* erect filaments simple with terminal tetrasporangia ..... *Rh. subimmersum.*
4) Plant forming prostrate filaments in the walls of *Sertularia;* tetrasporangia terminal on short erect filaments ..... *Rh. membranaceum.*

Rhodochorton tenue Kylin nov. sp.

Plant 3—5 mm high; basal layer consisting of creeping filaments; erect filaments more or less branched; branches alternate or 2—4 seriate; cells in the upper part of the erect filaments 5—7 μ thick and 5—6 times as long as broad, in the lower part 7—9 μ thick and 4—5 times as long as broad; cells in the creeping filaments 9—11 μ thick and 2—4 times as long as broad [1].

San Juan Island, north of Conception Point; densely covering rocks and stones at high-water mark.

This new species is most nearly related to *Rhodochorton Rothii* from the Atlantic Sea, but differs from this in having much thinner and longer cells. The cells in *Rh. Rothii* are 10—18 μ thick and 1—3 times as long as broad. As

[1] *Rhodochorton tenue* Kylin nov. sp. — Frons 3—5 mm alta; stratum basale e filamentis repentibus constitutum; fila erecta plus minus ramosa; ramuli alterni vel unilateraliter 2—4-seriati; cellulae filorum erectorum superiores 5—7 μ crassae, diametro 5—6-plo longiores, inferiores 7—9 μ crassae, diametro 4—5-plo longiores; cellulae filamentorum repentium 9—11 μ crassae, diametro 2—4-plo longiores.

to its occurrence at high-water mark *Rh. tenue* corresponds with the European *Rh. Rothii.*

In fig. 25 *f—g* I have given two drawings of *Rhodochorton subsimplex* (Harv.) De-Toni Syll. Alg. 4 p. 1515 after a type specimen in J. Agardh's herbarium. The cells of this species which is collected at Friendly Islands are 15—20 μ thick and 8—10 times as long as broad.

Rhodochorton penicilliforme (Kjellm.) Rosenv. Alg. mar. du Groenland p. 66. *Thamnidium mesocarpum f. penicilliformis* Kjellm. (1875) Spetsb. Thalloph. 1 p. 30; *Rhodochorton mesocarpum f. penicilliformis* Kjellm. Alg. Arct. Sea p. 187 pl. 16. — Type specimens from the Arctic Sea (Spitzbergen).

Canoe Island and Peavine Pass; in the sublitoral zone, growing on different algae or on *Sertularia;* with tetraspores.

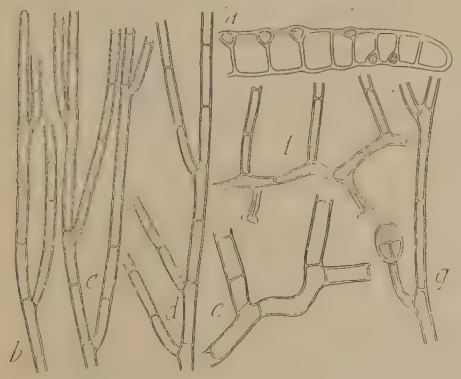

Fig. 25. *a Trailliella intricata* growing tip with glandular cells; *b—e Rhodochorton tenue; f—g Rh. subsimplex.* — *a* × 190; *b—e* × 250; *f* × 70; *g* × 100.

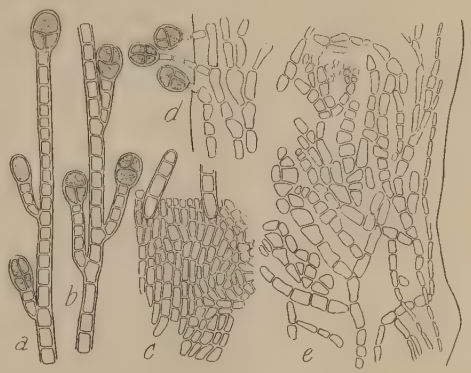

Fig. 26. *a—e Rhodochorton penicilliforme; d—e Rh. membranaceum.* — *a—d* × 190; *e* × 100.

Rhodochorton subimmersum Setch. et Gardn. (1903) Alg. Northwest. Amer. p. 347 pl. 17. — Type specimens from Whidbey Island, Wash.

West coast of Whidbey Island; forming irregular patches in the frond of *Grateloupia Cutleriae* (Setchell and Gardner 1903 p. 347).

Rhodochorton membranaceum Magnus (1874) Botan. Ergebn. der Nordseefahrt p. 67. pl. 2. — Type specimens from the North Sea.

Canoe Island; Peavine Pass; growing in the walls of *Sertularia* in the sublitoral zone; with tetraspores.

Antithamnion Näg. (1847).

A) Each cell in the main branches with two opposite branchlets.
   a) Branchlets branched; pectinate on the upper side..... *A. defectum.*
   b) Branchlets unbranched.

1) No glandular cells; tetrasporangia pedicellate.
   * Branchlets shorter than the articulations in the mature main branches. *A. floccosum.*
   **) Branchlets 2—3 times longer than the articulations ..... *A. pacificum.*
2) Branchlets with glandular cells; tetrasporangia unpedicellate *A. glanduliferum.*

B) The cells in the main branches with whorls of 3—4 branchlets.
   a) Branchlets at the base 15—20 μ thick; ultimate ramuli with round tips. *A. occidentale.*
   b) Branchlets at the base 25—50 μ thick; ultimate ramuli with acute, subulate tips. *A. subulatum.*

Fig. 27. *Antithamnion defectum.* — *gl* glandular cell. — *a* × 70; *b* × 220.

Antithamnion defectum Kylin nov. sp.

Frond 2—4 cm high, slightly branched; each cell in the main branches with two opposite branchlets, pectinate on the upper side; no branchlet opposite a main branch; ultimate ramuli with round tips, often provided with glandular cells; cells in the main branches 50—80 μ thick, 2—5 times as long as broad; tetrasporangia pedicellate, cruciately divided [1].

[1] *Antithamnion defectum* Kylin nov. sp. — Frons 2—4 cm alta, sparse ramosa; cellulae ramorum pinnis oppositis, superiore latere pectinatis, ornatae; nulla pinna ramis opposita; ramuli ultimi apice rotundati, cellulis glandulinis ornati; cellulae ramorum 50—80 μ crassae, diametro 2—5-plo longiores; tetrasporangia pedicellata, cruciatim divisa.

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island; Peavine Pass; dredged at a depth of 5—10 fathoms; with tetrasporangia.

This species seems to be related to *Antithamnion ramulosum* (Kylin 1919 p. 70) and *A. simile* (Kützing Tab. Phyc. 11 pl. 82). An interesting and curious fact concerning *A. defectum* is that there is no branchlet opposite a main branch.

Antithamnion floccosum (Müll.) Kleen Nordl. Alg. p. 21, *Conferva floccosa* Müll. (1780) Fl. Dan. Fasc. 14 p. 7 pl. 828; *Callithamnion floccosum* Harv. Phyc. Brit. pl. 81. — Type specimens from northern Atlantic Ocean.

San Juan Island, on the piles of Friday Harbor's docks; with tetrasporangia.

Antithamnion pacificum (Harv.) Kylin nov. comb.; *Callithamnion floccosum* var. *pacificum* Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 176; Tilden Amer. Alg. No. 309. — Type specimens from Orcas Island, Wash., and Vancouver Island (Esquimalt).

San Juan Island, on the piles of Friday Harbor's docks, and near Cattle Point; with gonimoblasts and tetrasporangia.

In fig. 29 *a—d* I have given some drawings concerning the development of the gonimoblast. A good description of the development is given by Daines (1913 p. 286), and therefore I only refer to the paper of this author.

Antithamnion glanduliferum Kylin nov. sp.

Frond 2—3 cm high, branched; main branches with opposite branchlets; branchlets unbranched, prominent, of about the same length as the articulations in the mature main branches, provided with glandular cells; older main branches 60—100 μ thick and with cells 3—5 times as long as broad; tetrasporangia unpedicellate, cruciately divided [1].

San Juan Island, at Friday Harbor's docks; growing on old *Laminaria*-leaves; with tetrasporangia.

This species is most nearly related to *Antithamnion floccosum*, but it differs from this one in having unpedicellate tetrasporangia, and glandular cells on the branchlets.

Antithamnion occidentale Kylin nov. sp.; *Callithamnion americanum* Harv. in Journ. Linn. Soc. Bot. Vol. 6 p. 175 (sec. spec. orig.); non Harv. Ner. Bor. Amer. p. 238 pl. 36 a; *Antithamnion americanum* Setch. et Gardn. Alg. Northwest. Amer. p. 342.

Frond 4—8 cm high, irregularly branched, with whorls of 3—4 branchlets; branchlets irregularly branched, at the base 15—20 μ thick; ultimate ramuli with round tips; glandular cells numerous; cells in the older main branches 125—175 μ

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[1] *Antithamnion glanduliferum* Kylin nov. sp. — Frons 2—3 cm alta, ramosa et opposite pinnata, pinnae simplices, patentes, cellulis glandulinis ornatae, inferiores articulo, quo insident, non longiores; rami inferne 60—100 μ crassi, cellulis diametro 3—5-plo longioribus; tetrasporangia non pedicellata, cruciatim divisa.

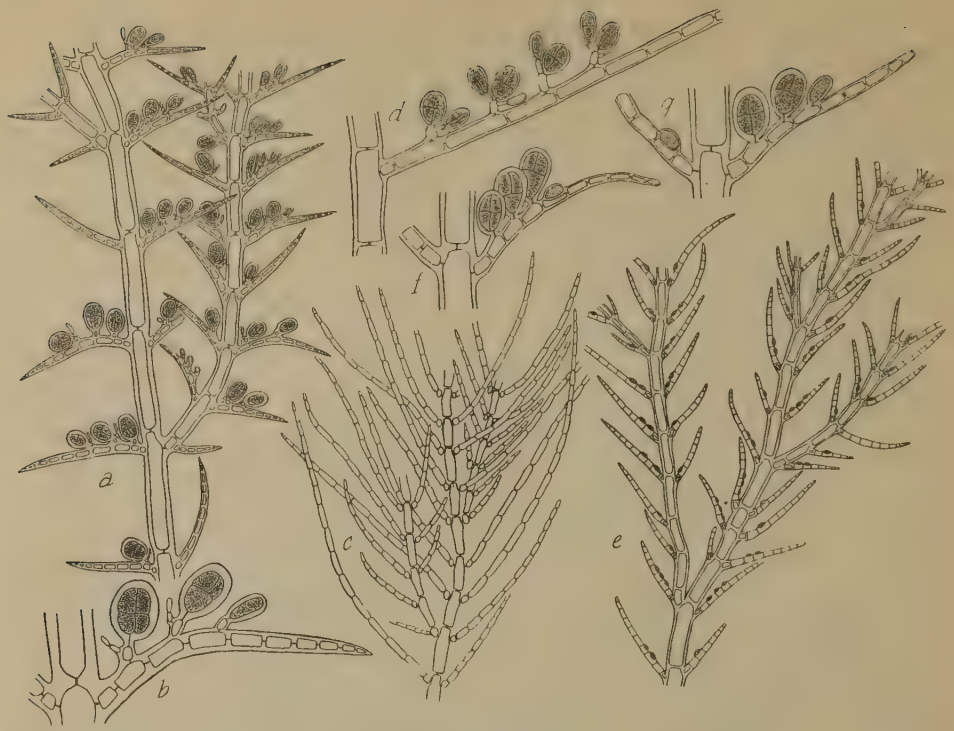

Fig. 28. *a—b Antithamnion floccosum; c—d A. pacificum; e—g A. glanduliferum.* — *a* × 50; *b* × 160; *c* × 50; *d* × 90; *e* × 50; *f—g* × 160.

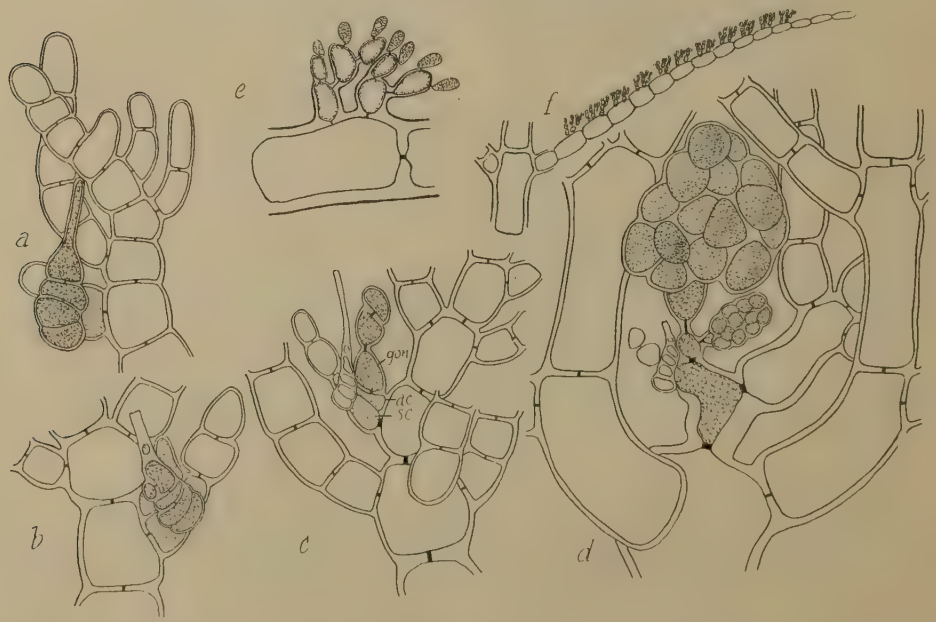

Fig. 29. *Antithamnion pacificum; a* carpogonial branch; *b—d* development of the gonimoblast; *e—f* branches with spermatangia. — *ac* auxiliary cell; *gon* first gonimoblast cell; *sc.* supporting cell. — *a—b* × 550; *c* × 410; *d* × 300; *e* × 550; *f* × 170.

thick, 3—4 times as long as broad; gonimoblasts sessile on the upper branches; tetrasporangia sessile on the branchlets, cruciately divided [1].

San Juan Island, on the piles of Friday Harbor's docks and near Cattle Point; Peavine Pass, dredged at a depth of 5—10 fathoms; with gonimoblasts and tetraspores.

Antithamnion occidentale is related to *A. americanum*, but it differs from this one in having the branchlets in whorls; in specimens of *A. americanum* I have only seen opposite branchlets. *A. americanum* generally seems to lack glandular cells; I have

Fig. 30. *a—d Antithamnion occidentale; f A. floccosum.* — *ac* auxiliary cell; *gl* glandular cell; *gon* first gonimoblast cell; *sc* supporting cell. — *a* × 70; *b—c* × 390; *d—e* 285; *f* × 220.

examined several specimens, but only in one specimen, communicated in Phykoth. univ. No. 501, I found some glandular cells; I am not quite sure whether this specimen represents a true *A. americanum* or not.

Setchell and Gardner (1903 p. 342 and p. 344) suppose *Antithamnion Pylaisaei* and *A. boreale* to occur in the vicinity of Friday Harbor. I never found

[1] *Antithamnion occidentale* Kylin nov. sp. — Frons 4—8 cm alta vage ramosa, verticillis 3—4 pinnarum ornata; pinnae vage ramosae, basi 15—20 μ crassae; ultimi ramuli apice rotundati; cellulae glandulinae numerosissimae; rami inferne 125—175 μ crassi, cellulis diametro 3—4-plo longioribus; gonimoblasti in ramis superioribus sessiles; tetrasporangia in pinnis sessilia, cruciatim divisa.

any specimens referable to any one of them, and I think that Setchell's and Gardner's plants represent forms of the new-described species *A. occidentale.* Setchell and Gardner (l. c.) pretend that the specimens of *A. Pylaisaei* and *A. americanum* (= *A. occidentale*) are better distinguishable from each other by habit than by any microscopical characters and that »all the species of *Antithamnion* seem to be connected by intermediate forms from the simplest forms of *A. boreale* up to the most complex forms of *A. Pylaisaei* or *A. subulatum.*» I think this is to be explained in such way that the specimens which Setchell and Gardner have referred to *A. americanum*, *A. Pylaisaei* and *A. boreale* represent forms of one and the same species, viz. *A. occidentale.*

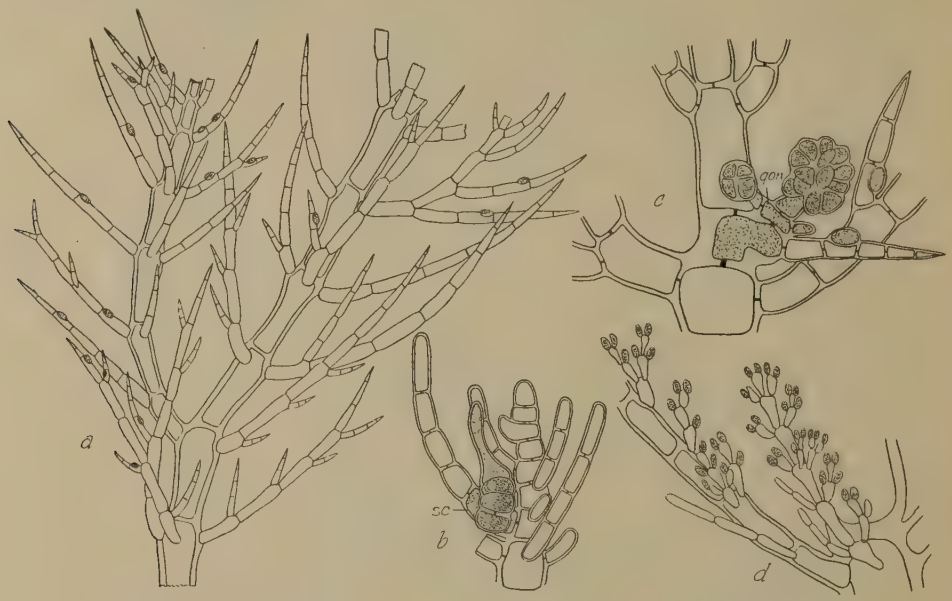

Fig. 31. *Antithamnion subulatum.* — *gon* first gonimoblast cell; *sc* supporting cell. — *a* × 70; *b* × 390; *c* × 220; *d* 390.

Antithamnion subulatum (Harv.) J. Ag. Anal. Alg. 1892 p. 20; *Callithamnion subulatum* Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 175. — Type specimens from Vancouver Island (Esquimalt).

San Juan Island, on the piles of Friday Harbor's docks; Shaw Island and Canoe Island, dredged at a depth of 5—10 fathoms; with gonimoblasts.

Setchell and Gardner (1903 p. 342) say that »the type seems to have disappeared, since Professor W. G. Farlow has searched for it both at Dublin and at London without success», and for that reason these authors have accepted *Antithamnion subulatum* in Phycoth. Boreal. Amer. No. 944 as representing the species *A. subulatum* Harv. Later on the type has been found in Herb. Harvey (Collins 1913 p. 125) and is said to agree with P. B. A. No. 944. — In J. Agardh's herbarium

there is, however, one of HARVEY's type specimens and therefore it is possible for me to do a true determination of some specimens of *A. subulatum* in my collection from Friday Harbor and also to give a drawing of the true *A. subulatum*. The above-mentioned number in Phycoth. Boreal. Amer., at least in my copy, has nothing to do with *A. subulatum* Harv.

A. subulatum Harv. is evidently nearly related to *A. occidentale* (see above), but is quite distinct from this one, and I never saw any intermediate specimens. *A. subulatum* is in all parts stouter than *A. occidentale*, and the stoutness is especially perceivable on the branchlets (see the key). Then there is a difference between *A. occidentale* and *A. subulatum* concerning the tips of the ultimate ramuli (see the key).

Platythamnion J. Ag. (1892).

1) Older, lateral branchlets below with three rows of ramuli, two on the upper and one on the lower side ..... *Pl. villosum.*
2) Older, lateral branchlets below with two rows of ramuli on the upper side, only the undermost cell sometimes with a branch on the lower side ..... *Pl. pectinatum.*
3) Older, lateral branchlets with four rows of ramuli, the larger ones on the upper and the lower side, the smaller ones on the lateral sides; on the young branchlets the larger ramuli occur on the lower side..... ..... *Pl. reversum.*

Platythamnion villosum Kylin nov. sp.; *Pl. heteromorphum f. typicum* Setch. et Gardn. Alg. Northwest. Amer. p. 344; *Callithamnion subulatum* Tilden Amer. Alg. No. 310.

Frond 4—6 cm high, more or less dichotomously branched, with whorls of four branchlets; the two lateral branchlets in mature stage with three rows of branched ramuli, two on the upper side and one on the lower side; the two transversal branchlets smaller than the lateral ones, irregularly branched; ultimate ramuli subulate, at the base 6—8 μ thick, with cells 2—3 times as long as broad; older main branches 150—300 μ thick, with cells 2—3 times as long as broad; gonimoblasts sessile on the upper branches; tetrasporangia sessile, sometimes pedicellate, on the branchlets, cruciately divided [1].

San Juan Island, on the piles of Friday Harbor's docks; Shaw Island and Canoe Island, dredged at a depth of 5—10 fathoms; with gonimoblasts and tetrasporangia.

This species has formerly been identified with *Platythamnion heteromorphum* J. Ag., but the type specimen in J. AGARDH's herbarium collected at the Californian

[1] *Platythamnion villosum* Kylin nov. sp. — Frons 4—6 cm alta, subdichotome ramosa, pinnis quaternis dense verticillata; pinnae laterales maturae in inferiore parte ternis seriebus ramulorum ramosorum, superiore latere binis, inferiore latere singula, ornatae; pinnae transversales lateralibus minores, irregulariter ramosae; ramuli ultimi subulati, inferne 6—8 μ crassi, cellulis diametro 2—3-plo longioribus; rami principales inferne 150—300 μ crassi, cellulis diametro 2—3-plo longioribus; gonimoblasti in ramis superioribus sessiles; tetrasporangia in pinnis sessilia, raro pedicellata, cruciatim divisa.

Fig. 32. *a—b Platythamnion villosum, c Pl. heteromorphum; d Pl. pectinatum.* — *a* × 175; *b* × 230; *c—d* × 125.

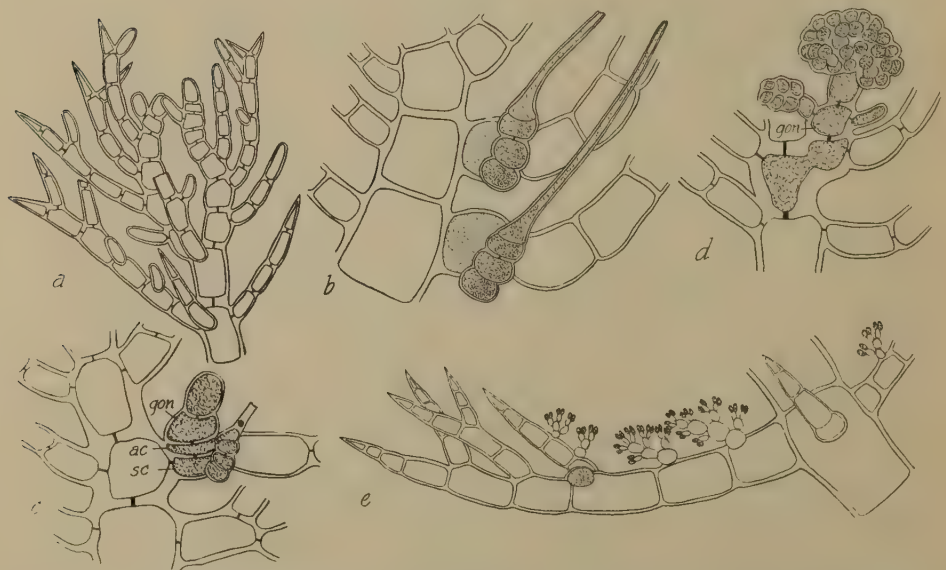

Fig. 33. *a—d Platythamnion villosum; e Pl. pectinatum.* — *ac* auxiliary cell; *gon* first gonimoblast cell; *sc* supporting cell. — *a* × 390; *b* × 530; *c* × 390; *d—e* × 285.

coast represents quite another alga than that one referred to *Pl. heteromorphum* by Setchell and Gardner (1903 p. 344). The fig. 32 *a* and *c* will easely show the difference between the two species.

The genus *Platythamnion* is nearly related to *Antithamnion*, and I have not found any fundamental difference between the two genera concerning the development of the carpogonial branches and the gonimoblasts. It is, however, a difference in the vegetative system. In *Platythamnion* there are four branchlets on each cell

Fig. 34. *a—c Platythamnion pectinatum; d—f Pl. reversum.* — *a* × 160; *b* × 390; *c* × 530; *d* × 390; *e* × 530; *f* × 160.

of the main branches, two lateral larger ones and two transversal smaller ones. In *Antithamnion* there are two or three, sometimes four branchlets, but in the later case there is no such fundamental difference between the lateral and the transversal ones as in *Platythamnion*. There is also a difference concerning the growing tip. In *Platythamnion* the main branch begins to grow out earlier than the two (or three) branchlets below it (fig. 33 *a*, 34 *b* and *d*); in *Antithamnion* the branchlet below a main branch grows out earlier than the main branch itself (fig. 30 *b* and *f*).

Platythamnion pectinatum Kylin nov. sp.

Older, lateral branchlets below with two rows of branched ramuli on the upper

side, only the undermost cell sometimes with a branch on the lower side; in other respects as in *Pl. villosum* [1].

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island and Peavine Pass, dredged at a depth of 5—10 fathoms; with gonimoblasts and tetraspores.

Platythamnion reversum (Setch. et Gardn.) Kylin nov. comb.; *Pl. heteromorphum f. reversum* Setch. et Gardn. (1903) Alg. Northwest. Amer. p. 345 pl. 25. — Type specimens from Whidbey Island, Wash.

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island and Peavine Pass, dredged at a depth of 5—10 fathoms; with gonimoblasts and tetraspores.

Callithamnion Lyngb. (1819).

1) Side branches distichous ..... *C. biseriatum.*
2) Side branches alternate, not distichous.
   a) Main branches not corticate, or only below with a few rhizoids ..... *C. acutum.*
   b) Main branches densely corticate with rhizoids and small lateral branchlets. *C. Pikeanum.*

Callithamnion biseriatum Kylin nov. sp.

Frond 1—2 cm high with distichous branches; branchlets distichously pinnate, generally throughout branched with the side branches of the two undermost cells on the upper side of the branchlet, sometimes naked below; main branches not corticate, 100—150 μ thick, below with cells 1—2 times as long as broad, above with cells 2—4 times as long as broad; gonimoblasts on the sides of the upper branches, round, sometimes divided in 2 or 3 round gonimolobes; tetrasporangia often 2 or 3 together, pedicellate or unpedicellate on the upper side of the ultimate ramuli [2].

San Juan Island, on the piles of Friday Harbor's docks; Brown Island and Peavine Pass, growing on algae, dredged at a depth of 5—10 fathoms; with gonimoblasts and tetrasporangia.

It is possible that this new-described alga is identical with the plant referred to *Callithamnion polyspermum* by Setchell and Gardner (1903 p. 338), but it is not identical with the plant referred to *C. polyspermum* by Harvey (1862 p. 175). In J. Agardh's herbarium I have seen one of Harvey's specimens, which is sterile and because of that impossible to name with certainty, but it differs considerably

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[1] *Platythamnion pectinatum* Kylin nov. sp. — Pinnae laterales matûrae in inferiore parte superioris lateris binis seriebus ramulorum ramosorum ornatae; cellula basalis pinnarum nonumquam inferiore latere ramosa, ceterae cellulae inferiore latere non ramosae; cetera ut in *Pl. villoso.*

[2] *Callithamnion biseriatum* Kylin nov. sp. — Frons 1—2 cm alta, distiche decomposita; pinnae distiche pinnatae, saepius e basi ramosae ramulis cellularum inferiorum e superiore latere egredientibus, nonnumquam inferne non ramosae; rami principales ecorticati, 100—150 μ crassi, inferne e cellulis diametro 1—2-plo longioribus, superne e cellulis diametro 2—4-plo longioribus constituti; gonimoblasti in ramis superioribus laterales, rotundati vel in gonimolobos rotundatos divisi; tetrasporangia pedicellata vel non pedicellata, saepius bini vel terni in latere superiore ramulorum ultimorum congregata.

from *C. biseriatum.* — In fig. 35 I have given some drawings concerning the development of the procarp and the gonimoblast in *C. biseriatum* showing that the alga follows the ordinary *Callithamnion* schedule.

Callithamnion acutum Kylin nov. sp.

Frond 3—4 cm high with alternate branches; branchlets irregularly pinnate; main branches not corticate, sometimes below with a few rhizoids, 60—100 μ thick, with cells 6—12 times as long as broad; ultimate ramuli subulate with an acute tip,

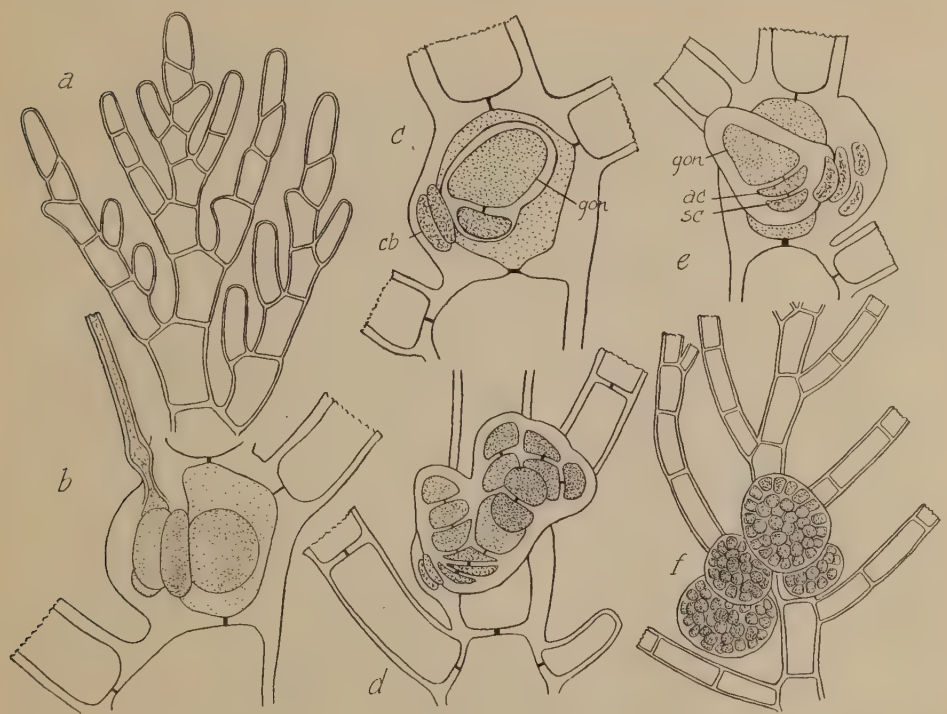

Fig. 35. *Callithamnion biseriatum.* *a* growing tip; *b—f* development of the gonimoblast. — *ac* auxiliary cell; *cb* carpogonial branch; *gon* first gonimoblast cell; *sc* supporting cell. — *a* × 290; *b* × 700; *c* 520; *d—e* × 380; *f* × 90.

below 20—30 μ thick, with cells 3—4 times as long as broad; gonimoblasts round on the sides of the upper branches; plant dioecious [1].

San Juan Island, growing on fishing-tackles near Cattle Point; with gonimoblasts.

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[1] *Callithamnion acutum* Kylin nov. sp. — Frons 3—4 cm alta, quoquoversum ramosa; pinnae irregulariter pinnatae; rami principales ecorticati, nonnumquam inferne rhizoideis nonnullis ornati, 60—100 μ crassi, e cellulis diametro 6—12-plo longioribus constituti; ramuli ultimi subulati, apice acuti, inferne 20—30 μ crassi, cellulis diametro 3—4-plo longioribus; gonimoblasti in ramis superioribus laterales, rotundati; planta dioica.

I think this species is identical with the plant referred to *Callithamnion Baileyi* by Setchell and Gardner (1903 S. 339). It belongs to the group of *Callithamnion* species represented on the European coasts by *C. tetragonum* and *C. fruticulosum*, and on the east coast of North America by *C. Baileyi*, but it differs from all these plants in being dioecious, not monoecious. It also differs from these plants in being smaller and slenderer with thinner main branches.

Callithamnion Pikeanum Harv. (1853) Ner. Bor. Amer. p. 230; *Ceratothamnion Pikeanum* Setch. et Gardn. Alg. Northwest. Amer. p. 339; *Callithamnion arbuscula* Tilden Amer. Alg. No. 311. — Type specimens from California (Golden Gate).

Fig. 36. *a—c Callithamnion biseriatum; d—e Callithamnion acutum* (*e* growing tip with procarps). — *a* × 60; *b* × 40; *c* × 230; *d* × 60; *e* × 180.

San Juan Island, Brown Island and Turn Rock, growing on vertical rocks in the litoral zone (the typical form); on the piles of Friday Harbor's docks (the form *laxum* Setch. et Gardn. l. c.); with tetraspores.

Pleonosporium Naeg. (1861).

1) Sporangia ellipsoid, 60—70 μ long and 45—50 μ broad; spermatangia alternate on the upper and lower sides of the ultimate ramuli ..... *Pl. vancouverianum.*
2) Sporangia oviform, 100—120 μ long and 50—60 μ broad; spermatangia secundate on the upper side of the ultimate ramuli ..... *Pl. squarrosum.*

Pleonosporium vancouverianum J. Ag. Anal. Algol. 1892 p. 37; *Callithamnion vancouverianum* J. Ag. (1876) Epicr. p. 30; *C. thuyoideum* Harv. in Journ. Linn. Soc. Bot. Vol. 6. p. 175. — Type specimens from Vancouver Island (Esquimalt).

San Juan Island, on the piles of Friday Harbor's docks; Peavine Pass, on larger algae, dredged at a depth of 5—10 fathoms; with procarps and sporangia.

De Toni (Syll. Alg. 4 p. 1309) has identified this species with *Callithamnion venustissimum* Kütz. (Tab. Phyc. 12 pl. 1). I do not think this is right. Kützing's

Fig. 37. *a—c Pleonosporium vancouverianum. a* branch with sporangia; *b* branch with spermatangia; *c* sporangium; *d—g Pleonosporium squarrosum. d* branch with sporangia; *e* branch with spermatangia; *f* sporangium; *g* procarp. — *a* × 65; *b* × 150; *c* × 380; *d* × 45; *e* × 100; *f* × 275; *g* × 850.

figure shows that in *C. venustissimum* the side branch from the undermost cell of a branch often occurs on the upper side, but in *Pl. vancouverianum* it always occurs on the lower side.

Pleonosporium squarrosum Kylin nov. sp.

Frond 2—3 cm high with distichous branches; branchlets distichously pinnate, sometimes naked below, sometimes throughout branched with the side branch of the undermost cell on the lower side of the branchlet; main branches not corticate, 150—250 μ thick, with cells 3—4 times as long as broad; sporangia with many spores, oviform, 100—120 μ long and 50—60 μ broad, sessile on the ultimate

ramuli, 'generally alternate on their upper and lower sides, sometimes secundate on their upper side; spermatangia secundate on the upper side of the ultimate ramuli; procarps subterminal [1].

San Juan Island, on the piles of Friday Harbor's docks; with procarps and sporangia.

In sterile stage this new-described species differs from *Pl. vancouverianum* in having longer ultimate ramuli. The ramification in *Pl. squarrosum* is somewhat squarrose and not so dense as in *Pl. vancouverianum*. — In both species I have seen unfertilized procarps but no fertilized ones. The figure 37 *g* shows a procarp of *Pl. squarrosum* before the fertilization. The procarp is developed from the subterminal cell of a branchlet, the terminal cell being pushed aside. From the subterminal cell a lateral pericentral one is cut off, representing the supporting cell, which will before the development of the four-celled carpogonial branch cut off a small sterile cell. The subterminal cell also gives birth to a transversal one, probably representing the mother cell of a second auxiliary cell. — There is no difference in the development of the procarps in *Pl. squarrosum* and in *Pl. vancouverianum*

Griffithsia Ag. (1817).

Griffithsia pacifica Kylin nov. sp.

Frond 4—5 cm high, regularly dichotomously branched; articulations cylindrical, sometimes a little inflated above, 300—500 μ thick and 5—7 times as long as broad, without any sterile branchlets; procarps lateral on the upper branches; spermatangia on richly branched, small branchlets between the articulations of the upper branches, without any involucral rays; tetrasporangia on small branchlets between the articulations of the upper branches with unicellular involucral rays, developed from the tetrasporic branchlets [2].

San Juan Island, on the piles of Friday Harbor's docks; Turn Island, dredged at a depth of 5—10 fathoms; with procarps and tetrasporangia.

Concerning the development of the procarps this new-described species agrees with *Griffithsia antarctica* (Skottsberg 1923 p. 58). On each procarpic branch there is only one lateral pericentral cell and thus only one carpogonial branch

[1] *Pleonosporium squarrosum* Kylin nov. sp. — Frons 2—3 cm alta, distiche decomposita, pinnae distiche pinnatae, inferne ramosae vel non ramosae, ramulo cellulae infimae ex inferiore latere egrediente; rami principales ecorticati, 150—250 μ crassi, cellulis diametro 3—4-plo longioribus; sporangia sporis pluribus ornata, oviformia, 100—120 μ longa et 50 - 60 μ lata, in ramis ultimis sessilia, saepius in latere superiore et inferiore alternantia, nonnunquam in latere superiore secunda; spermatangia in latere superiore ramulorum ultimorum secunda; procarpia subterminalia.

[2] *Griffithsia pacifica* Kylin nov. sp. — Frons 4—5 cm alta, regulariter dichotome fastigiata; articuli cylindracei, nonnunquam superne leviter inflati, 300—500 μ crassi, diametro 5—7-plo longiores, ramulis sterilibus destituti; procarpia in ramis superioribus lateralia; spermatangia in ramulis ramosissimis inter articulos ramorum superiorum sedentia, involucris destituta; tetrasporangia in ramulis inter articulos ramorum superiorum sedentia, involucris ornata; ramuli involucrantes incurvati, articulo unico constantes, e ramulis sporiferis orientes.

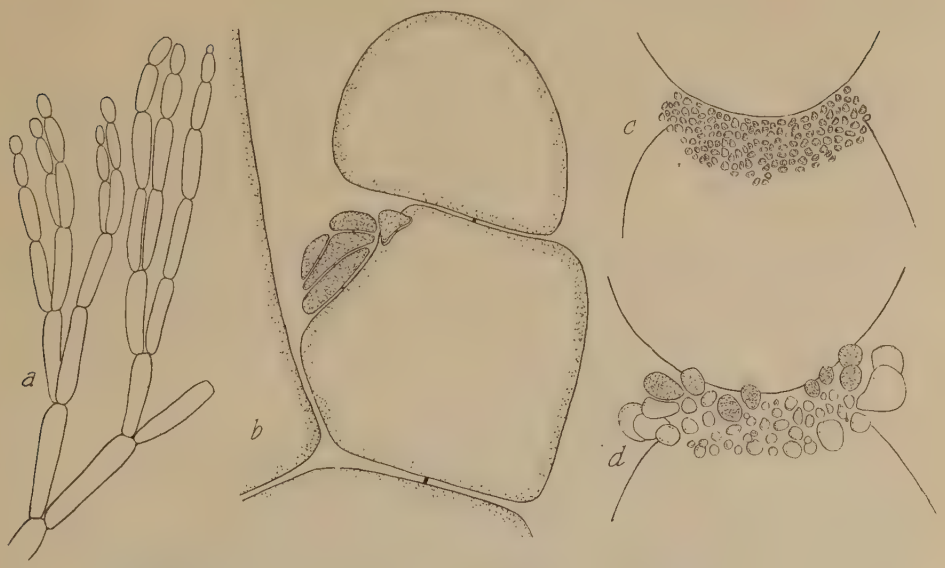

Fig. 38. *Griffithsia pacifica.* *a* sterile branch; *b* growing tip with a female branchlet; *c* young spermatangial branchlets; *d* young tetrasporic branchlets. — *a* × 10; *b* × 390; *c—d* × 160.

Fig. 39. *Griffithsia pacifica.* — *a—b* development of the procarp; *c* branchlet with spermatangia; *d—g* tetrasporic branchlets. — *a—c* × 380; *d—g* × 150.

(fig. 39 *b*), never two lateral pericentral cells and two carpogonial branches as in *Gr. corallina* (Kylin 1916 p. 107). I have not seen any fertilized procarps in *Gr. pacifica.* — As a peculiarity has to be mentioned that every articulation, carrying a procarp, has two sterile branchlets, one on each side of the procarpic

branch (fig. 38 *b* and 39 *a*). On other articulations there are never any sterile branchlets.

In *Gr. pacifica* there are not any involucral rays developed from the same joint that carries the male branchlets. In this respect *Gr. pacifica* agrees with *Gr. corallina*, but not with *Gr. antarctica*. In *Gr. pacifica* the outmost cells of the male branchlets are bigger and more inflated than the other ones, and form a kind of involucre (fig. 39 *c*).

The involucre of the tetrasporangia grows out from the tetrasporic filaments as in *Gr. corallina;* each ray consists of only one large cell, not as in *Gr. corallina* of two cells. In *Gr. antarctica* the involucre originates from the same joint that carries the tetrasporic branchlets.

Ptilota C. Ag. (1817).

Ptilota tenuis Kylin nov. sp.; *Pt. plumosa* Tilden Amer. Alg. No. 306; *Pt. pectinata* forma *tenuis* Collins, Holden and Setchell P. B. A. No. 1148 (without description).

Frond 4—9 cm high, richly branched; branches opposite; the opposite branches similar to each other, or one long and branched, the other short and abortive; branchlets lanceolate, slightly curved upwards, serrate, especially on the outer edge, with an acute tip; tetrasporangia in clusters on small branchlets opposite the bigger branchlets, or on the edges (especially the inner ones) of the bigger branchlets [1].

Brown Island, on rocks between tides; with tetrasporangia.

Among the *Ptilota*-species there are two different groups, one represented by *Pt. densa, Pt. asplenoides, Pt. hypnoides* and *Pt. californica*, the other by *Pt. plumosa.* In the first-mentioned group the leaf-like branchlets have a limited growth, and do not grow out into branches, in the second group the branchlets commonly grow out into long branches. In both groups the origins of the long branches are to be found opposite the branchlets. Sometimes these origins grow out into branches, sometimes not. The new-described *Ptilota tenuis* belongs to the second group; in this species it is very common that the branchlets grow out into long branches and that the branch-origin opposite a branchlet also develops into a long branch. In this respect *Pt. tenuis* is related to *Pt. plumosa.* There is, however, a good habitual difference between these two species; *Pt. tenuis* is a much more delicate form than *Pt. plumosa,* resembling rather *Plumaria elegans* in habit. Further, there are some differences in the position and the development of the tetrasporic branchlets. *Pt. filicina* also belongs to this group; it is, however, somewhat coarser than *Pt.*

[1] *Ptilota tenuis* Kylin nov. sp. — Frons 4—9 cm alta, opposite ramosissima; rami oppositi conformes, vel alter longus et ramosus, alter brevis et defectus; pinneae lineari-lanceolatae, leviter curvatae, serratae (praecipue latere exteriore). apice acutae; tetrasporangia in pinnis minoribus pinnis majoribus oppositis congregata vel in ramulis secus margines (praecipue marginem interiorem) pinnarum majorum orientibus sedentia.

plumosa, but differs from this mainly in the big clusters of tetrasporic filaments, growing out from the leaf-like branchlets. *Pt. pectinata* (= *Pt. serrata*) is generally referred to the first-mentioned group. In habit it is very much alike *Pt. plumosa*, and it sometimes occurs that a leaf-like branchlet in *Pt. pectinata* grows out into a branch. In my opinion *Pt. pectinata* forms a transition between the two above-mentioned groups.

Setchell and Gardner (1903 p. 340—341) assert that *Ptilota filicina* and *Pt. pectinata* occur in the vicinity of Friday Harbor. The specimen in Tilden Amer.

Fig. 40. *Ptilota tenuis*. *a* branch with tetraspores; *b* growing tip. — *a* × 50; *b* × 40.

Alg. No. 306, by these authors referred to *Pt. filicina* is, however, *Pt. tenuis*, and probably the plant from San Juan Island, which they refer to *Pt. pectinata*, is *Pt. tenuis*, too. But it is anyhow not impossible that *Pt. filicina* as well as *Pt. pectinata* are to be found in the vicinity of Friday Harbor. The type specimens of *Pt. filicina* are from Vancouver Island, and specimens of *Pt. pectinata* are at least collected at Alaska.

Ceramium Roth (1797).

1) Frond throughout densely corticate, colour red ..... *C. pacificum*.
2) Internodes slightly corticate, sometimes not corticate in the upper part of the frond; colour violet ..... *C. washingtoniense*.
3) Internodes not corticate; colour red..... *C. californicum*.

Ceramium pacificum (Collins) Kylin nov. comb; *Ceramium rubrum* var. *pacificum* Collins (1889) in Hauk et Richter Phykoth. univ. No. 302 (without descr.), in

Bull. Vict. Mem. Mus. No. 1 p. 125 (description); Collins, Holden and Setchell P. B. A. No. 893 and No. 1747; *C. diaphanum* Tilden Amer. Alg. No. 207. — Type specimens from California (Monterey).

San Juan Island, south of False Bay; on rocks in the lower part of the litoral zone.

In habit *Ceramium pacificum* differs so considerably from *C. rubrum* that in my opinion it ought to be considered as a distinct species. Especially is to be pointed out that *C. pacificum* in the somewhat older parts of the frond has a lot of small branchlets covering the main branches. In habit it resembles *C. pedicellatum* from the European coasts, but the small branchlets are much more numerous in *C. pacificum* than in *C. pedicellatum.*

Fig. 41. *Ceramium washingtoniense.* — 7/8 nat. size.

Ceramium washingtoniense Kylin nov. sp.

Frond 3—5 cm high; colour violet; the dichotomously divided main branches provided with numerous small, simple or forked branchlets, especially in the lower part of the frond; tips incurvated; cortical bands in the upper part of the frond sometimes slightly separated, the internodes, however, soon becoming corticated; the bark growing out from both edges of the cortical bands, but mostly from the lower one; bark thin, transparent, tetrasporangia immersed in the cortical bands [1].

San Juan Island, south of False Bay; on rocks midway between tides; with tetrasporangia.

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[1] *Ceramium washingtoniense* Kylin nov. sp. — Frons violacea, 3—5 cm alta; rami principales dichotome divisi, inferiore parte ramulis numerosis simplicibus vel furcatis ornati; apices incurvati; zonae superiores approximatae vel brevissime separatae, deinde ab utraque margine inprimis ab inferiore accrescentes; cortex internodiorum tenuis, pellucidus; tetrasporangia in zonis immersa.

Because of the numerous small side branches in the older parts of the frond this new-described species resembles *Ceramium pacificum* in habit, but it differs in its smaller size and in its violet colour; further, *C. washingtoniense* is not at all so densely corticated as *C. pacificum*. As to the forming of the bark it is especially to be pointed out that the lower edge of the cortical bands grows out more than the upper one.

Ceramium californicum J. Ag. (1894) Anal. Algol. cont. 2 p. 45; Collins, Holden and Setchell P. B. A. No. 447. — Type specimens from California.

Peavine Pass, on bigger algae dredged at a depth of 5—10 fathoms; with cystocarps and tetrasporangia.

In Collins, Holden and Setchell P. B. A. No. 2248 is to be read: »The plant from Santa Cruz, distributed as P. B. A. No. 447, agrees better with var. *decipiens* J. G. Agardh, Anal. Alg., Cont. II, p. 46, 1894. The present plant is of the typical form.» This is not quite right. The plant, distributed as No. 447, agrees very well with the type specimens in J. Agardh's herbarium, and really much better than the plant distributed as No. 2248 does. — The tetrasporangia in *C. californicum* are not immersed in the cortical belt as in the greater part of the *Ceramium*-species, but half emerged, with the outer side not corticated. — The plant collected at Whidbey Island and distributed as P. B. A. No. 1298 under the name of *C. tenuissimum* (Lyngb.) J. Ag. is not identical with *C. tenuissimum* from the European coasts. It is sterile, and thus hard to determine with certainty.

Microcladia Grev. (1830).

1) Frond somewhat compressed; branches alternate, distichous ..... *M. Coulteri.*
2) Frond not compressed; branches arched, dichotomous, with secundate branchlets on the upper side ..... *M. borealis.*

Microcladia Coulteri Harv. (1853) Ner. Bor. Amer. 2 p. 209 pl. 33. — Type specimens from California.

San Juan Island, south of False Bay; on algae in the upper sublitoral zone; with gonimoblasts and tetraspores.

Microcladia borealis Rupr. (1850) Alg. Ochot. p. 259; Harv. Ner. Bor. Amer. 2 p. 210. — Type specimens from Alaska (Unalaska).

San Juan Island, near Friday Harbor and south of False Bay; Brown Island; Turn Rock; on rocks in the litoral zone; with tetrasporangia.

Fam. **Delesseriaceae.**

Membranoptera Stackh. (1809).

1) Frond 3—6 cm high; branches 2—10 mm broad; midrib macroscopic; sidenerves microscopic ..... *M. platyphylla.*
2) Frond 2—3 cm high; branches 0,5—1 mm broad; midrib microscopic; no sidenerves *M. tenuis.*

Membranoptera platyphylla (Setch. et Gardn.) Kylin Stud. Deless. p. 15; *Pteridium serratum f. platyphyllum* Setch. et Gardn. (1903) Alg. Northwest. Amer. p. 325. — Type specimens from Pleasant Beach, Kitsap County, Wash.

San Juan Island, on the piles of Friday Harbor's docks; with cystocarps and tetrasporangia.

Membranoptera tenuis Kylin (1924) Stud. Deless. p. 16. — Type specimens from Canoe Island near Friday Harbor, Wash.

Canoe Island; Peavine Pass; dredged at a depth of 5—10 fathoms.

Delesseria Lamour (1813).

Delesseria decipiens J. Ag. (1872) Bidr. Florid. Syst. p. 58; Epicr. p. 492; Kylin Stud. Deless. p. 25; Tilden Amer. Alg. No. 211; *Apoglossum decipiens* J. Ag. Sp. Alg. III: 3 p. 194. — Type specimens from Vancouver Island.

San Juan Island, on the piles of Friday Harbor's docks; with cystocarps and tetrasporangia.

Polyneura Kylin (1924).

Polyneura latissima (Harv.) Kylin Stud. Deless. p. 37; *Hymenena latissima* Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 170; *Nitophyllum latissimum* J. Ag. Epicr. p. 464. Tilden Amer. Alg. No. 212. — Type specimens from Vancouver Island.

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, dredged at a depth of 5—10 fathoms; with cystocarps and tetrasporangia.

Heteronema Kylin (1924).

Heteronema boreale Kylin (1924) Stud. Deless. p. 49. — Type specimens from Canoe Island near Friday Harbor, Wash.

Canoe Island; Peavine Pass; dredged at a depth of 5—10 fathoms.

Nitophyllum Grev. (1830).

Nitophyllum mirabile Kylin nov. sp.

Frond 8—12 cm high, purplish red, subsessile, or shortly stalked, flat, membranous, destitute of venation, irregularly roundish, deeply lobed, margin not dentate; segments broad, ovate, or cuneate, lobed at the apices; cystocarps irregularly scattered over the surface; carpospores terminal on the gonimoblast filaments, which are connected with many cells in the bottom of the cystocarps; sporangia in

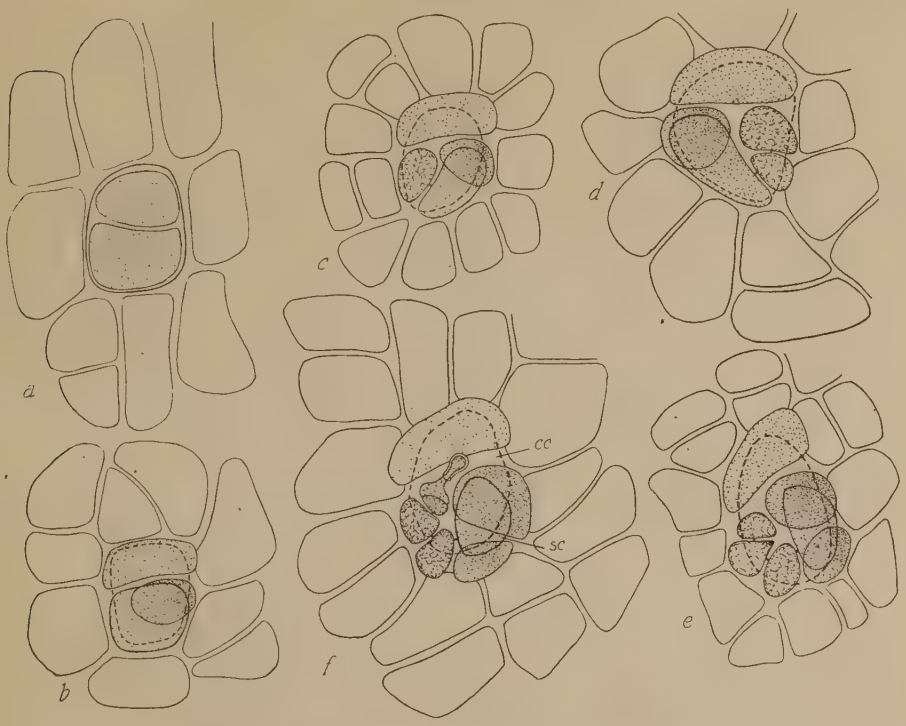

Fig. 42. *Nitophyllum mirabile;* development of the procarp. — *cc* central cell; *sc* supporting cell. — × 700.

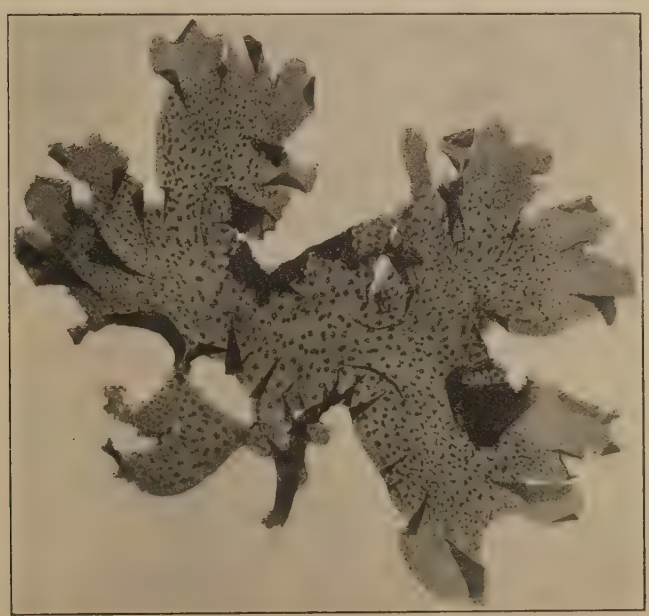

Fig. 43. *Nitophyllum mirabile.* — ²/₃ nat. size.

irregularly roundish or elliptical sori, 1—1,5 mm in diam., scattered over the surface [1].

Canoe Island, dredged at a depth of 5—10 fathoms; with cystocarps and tetrasporangia.

The fig. 42 shows the development of the procarp in this new-described *Nitophyllum*. The development is especially noteworthy, and in no other species of *Nitophyllum* in the old sense I have seen anything like it. It comes, however, most nearly to the development of the procarp in *Nitophyllum punctatum* (Kylin 1924 p. 71), and in consequence of this fact I have referred the new-described species to *Nitophyllum* and not to *Myriogramme* (Kylin 1924 p. 55). — In *Nitophyllum mirabile* the fertile pericentral cell at first divides into two cells one upper (in the direction of the growing tip of the frond) and one lower; and after that the lower one produces a procarp in the same way as the fertile pericentral cell in *Myriogramme*. In *Nitophyllum punctatum* the fertile pericentral cell divides into two cells, one to the right and one to the left; one of these cells then produces a procarp, but in a special way (see Kylin 1924 p. 71), not in the same way as in *N. mirabile*. I lay a particular stress upon the fact that in the genus *Nitophyllum* in a strict sense the fertile pericentral cell at first divides into two cells, of which only one gives birth to a procarp with real sterile cells and a carpogonial branch.

In the mature cystocarps of *N. mirabile* the spore-producing filaments are connected with many cells on the bottom of the cystocarp in the same way as in *Gonimophyllum australe* (Skottsberg 1923 p. 50) and in *Myriogramme erosa* (Kylin 1924 p. 61). The ordinary cystocarp type in the fam. Delesseriaceae shows a large fusion cell from which all spore-producing filaments emanate. As to this large fusion cell *N. punctatum* belongs to the ordinary type. — The carpospores in *N. mirabile* are terminal as in *N. punctatum*. In the above-mentioned *Myriogramme erosa* and *Gonimophyllum australe* there are many carpospores in each filament ranging one after the other. — Perhaps it were better to refer *N. mirabile* to a new genus, belonging to the *Nitophyllum*-group, not to the *Myriogramme*-group (Kylin 1924 p. 53 and p. 69).

Hymenena Grev. (1830).

1) Frond throughout very thin and membranous, without macroscopic nerves; sori small, elliptical, scattered over the entire frond, tending to become arranged into lines. *H. Fryeana.*

2) Frond below thick, often stem-like; macroscopic nerves present; sori linear extending flabellately from the nerves to the margin of the frond .... *H. flabelligera.*

[1] *Nitophyllum mirabile* Kylin nov. sp. — Frons 8—12 cm alta, purpureo-rosea, subsessilis, vel breviter pedicellata, tenuiter membranacea, avenia, ecostata, irregulariter rotundata, lobata; segmenta lata, ovata vel cuneata, marginibus edentata, apice lobata; cystocarpia per frondem irregulariter sparsa; carposporia in filamentis gonimoblasti terminalia; filamenta gonimoblastica cum cellulis inferioris partis pericarpii conjuncta; sori tetrasporiferi irregulariter rotundati vel elliptici, diam. c:a 1—1,5 mm, per frondem sparsi.

Hymenena Fryeana (Farl.) Kylin Stud. Deless. p. 81; *Nitophyllum Fryeanum* Farl. (1878) in Farlow, Anderson and Eaton Alg. Exs. Amer. Bor. No. 69; Nott in Proceed Calif. Acad. Sc. Bot. Ser. 3 Vol. 2 p. 22; non *N. Fryeanum* Harv. Ner. Bor. Amer. Suppl. p. 128. — Type specimens from Santa Cruz, Calif.

Peavine Pass, dredged at a depth of 5—10 fathoms; with tetrasporangia.

In the herbarium of the University at Upsala I have seen two specimens of an alga, collected by Gardner in 1908, at the west coast of Whidbey Island, Wash., which is supposed to be identical with *Nitophyllum ruthenicum* (Kjellman 1889 p. 25). The two specimens, one cystocarpic and the other tetrasporic, represent a *Hymenena*-species very closely related to *H. Fryeana* (Farl.) Kylin and probably identical with this species. — Microscopic veins are present, but not numerous; the carpospores are terminal on the gonimoblast filaments.

I have seen the type specimens of *Nitophyllum ruthenicum* Kjellm. (1889 p. 25). In this species there are no microscopic veins; in the gonimoblast filaments there are two or three carpospores, ranging one after the other. These two facts point out that the species in question represents a *Myriogramme*-species (Kylin 1924 p. 55). The species seems to be most nearly related to *M. Bonnemaisoni* from the European shores and to *M. livida* from the Falkland Islands.

Nitophyllum ruthenicum was originally described by Postels and Ruprecht (1840 p. 15) under the name *Wormskioldia ruthenica*. I have not seen any specimens of this latter one, I suppose, however, that it is identical with *N. ruthenicum* Kjellm., and the species ought then to be named *Myriogramme ruthenica* (Post. et Rupr.) Kylin.

Hymenena flabelligera (J. Ag.) Kylin Stud. Deless. p. 83; *Nitophyllum flabelligerum* J. Ag. (1876) Epicr. p. 699; *N. Harveyanum* Nott in Proceed. Calif. Acad. Sc. Bot. Ser. 3 Vol. 2 p. 29; non *N. Harveyanum* J. Ag. Bidr. Florid. Syst. p. 51. — Type specimens from Golden Gate, Calif.

San Juan Island, south of False Bay, on rocks at low water mark; with tetraspores.

Cryptopleura Kütz. (1843).

Cryptopleura Ruprechtiana (J. Ag.) Kylin Stud. Deless. p. 93; *Nitophyllum Ruprechtianum* J. Ag. (1872) Bidr. Florid. Syst. p. 51; *Hymenena fimbriata* Post. et Rupr. (1840) Illustr. Alg. p. 15 pl. 38 a; *Cryptopleura stenoglossum* Kylin Stud. Deless. p. 92 fig. 78. — Type specimens from Norfolk Sound (near Sitka) Alaska and from Kamtshatka.

Canoe Island, Turn Island, Peavine Pass, dredged at a depth of 5—10 fathoms.

I think that *Nitophyllum stenoglossum* J. Ag., *N. marginatum* J. Ag. and *N. Ruprechtianum* J. Ag. represent one and the same species. In a previous paper I mentioned my Friday Harbor specimens of the plant in question under the name *Cr. stenoglossum* (J. Ag.). Last summer I got some new specimens, which perfectly

agree with the old ones, and for the moment I suppose it is best to name them all *Cr. Ruprechtiana.* The margins of the somewhat older specimens are densely crisped and provided with numerous small prolifications.

Gonimophyllum Batt. (1892).

Gonimophyllum Skottsbergii Setch. (1923) in Univ. Calif. Publ. Bot. Vol. 10 p. 394; Kylin Stud. Deless. p. 96. — Type specimens from Lands End, San Francisco, Calif.

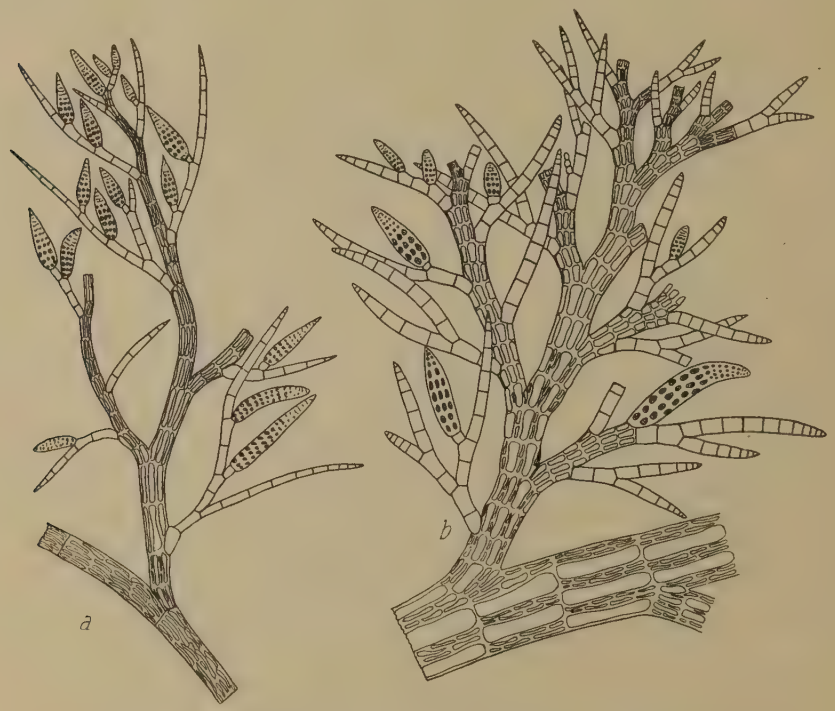

Fig. 44. *a Heterosiphonia laxa; b. H. densiuscula.* — *a* × 25; *b* × 35.

San Juan Island, south of False Bay, parasitic on *Hymenena flabelligera;* with cystocarps and tetraspores.

Fam: **Rhodomelaceae.**

Dasyopsis Zanard. (1843).

Dasyopsis plumosa (Harv. et Bail.) Schmitz in Ber. d. deutsch. bot. Ges. Bd 11 p. 231; *Dasya plumosa* Harv. et Bail. (1851) in U. S. Expl. Exped. p. 371;

Fig. 45. *Heterosiphonia densiuscula.* — $^{10}/_{7}$ nat. size.

Fig. 46. *Heterosiphonia laxa.* — $^{10}/_{7}$ nat. size.

Harv. Ner. Bor. Amer. 2 p. 66; *Dasyopsis plumosa* Collins, Holden and Setchell P. B. A. No. 942. — Type specimens from Puget Sound.

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Heterosiphonia Mont. (1842).

1) Frond densely branched; never more than two articulations between the side branches; articulations 0,5—1 times as long as broad ..... *H. densiuscula.*
2) Frond comparatively sparsely branched; 2—3 articulations between the side branches; articulations 1—2 times as long as broad ..... *H. laxa.*

Heterosiphonia densiuscula Kylin nov. sp.

Frond 4—5 cm high, corticate, but glabrous, densely, distichously branched; constantly two articulations between the side branches; articulations 0,5—1 times as long as broad, provided with 6—9 pericentral cells; main branches in the lower part of the frond up to 400 μ thick; stichidia either pedicellate or not; stipe, if present, monosiphonous or polysiphonous [1].

San Juan Island, on the piles of Friday Harbor's docks; Turn Island, dredged at a depth of 5—10 fathoms; with tetraspores.

Heterosiphonia laxa Kylin nov. sp.

Frond 5—8 cm high, corticate, but glabrous, comparatively sparsely, distichously branched; two or three articulations between the side branches, articulations 1—2 times as long as broad, provided with 6—9 pericentral cells; main branches in the lower part of the frond up to 400 μ thick; stichidia either pedicellate or not; stipe, if present, monosiphonous or polysiphonous [2].

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

The two new-described *Heterosiphonia*-species, *H. densiuscula* and *H. laxa*, are certainly closely related to each other, but I think it better to describe them as two distinct species than as forms of one and the same species. They are further related to *Heterosiphonia coccinea* from the European shores of the Atlantic Sea, but differ from this one in being of a smaller size and in having the main branches glabrous, not pubescent.

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[1] *Heterosiphonia densiuscula* Kylin nov. sp. — Frons 4—5 cm alta, corticata, glabrata, dense distiche ramosa; inter ramos laterales regulariter bina segmenta intermissa; articuli diametrum aequantes vel eo duplo breviores, 6—9 cellulis pericentralibus ornati; rami principales in inferiore parte frondis usque ad 400 μ crassi; stichidia pedicellata vel non pedicellata; pedicellum monosiphonium vel polysiphonium.

[2] *Heterosiphonia laxa* Kylin nov. sp. — Frons 5—8 cm alta, corticata, glabrata, laxe distiche ramosa; inter ramos laterales segmenta bina vel trina intermissa; articuli diam. 1—2-plo longiores, 6—9 cellulis pericentralibus ornati; rami principales in inferiore parte frondis usque ad 400 μ crassi; stichidia pedicellata vel non pedicellata; pedicellum monosiphonium vel polysiphonium.

Polysiphonia Grev. (1824).

1) 4 pericentral cells in each articulation.
   a) Branches without small, subulate branchlets ..... *P. urceolata.*
   b) Branches with numerous, small, subulate branchlets ..... *P. senticulosa.*
2) About 12 pericentral cells in each articulation ..... *P. tenuistriata.*

Polysiphonia urceolata (Dillw.) Grev. Flora Edin. p. 309; Harv. Phyc. Brit. pl. 167; *Conferva urceolata* Dillw. (1809) Brit. Conf. p. 82. — Type specimens from England.

San Juan Island, on the piles of Friday Harbor's docks; with cystocarps and tetraspores.

Polysiphonia senticulosa Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 169; non Collins, Holden and Setchell P. B. A. No. 638; *P. urceolata f. senticulosa* Collins in Victoria Mem. Museum Bull. 1 p. 119. — Type specimens from Orcas Island, Wash.

Orcas Island (Harvey 1862 p. 169).

Polysiphonia tenuistriata Hook et Harv. (1845) in Lond. Journ. Bot. Vol. 4 p. 266; Fl. Ant. 2 p. 479 pl. 183; Collins in Victoria Mem. Museum Bull. 1 p. 120; *P. atrorubescens* Harv. in Journ. Linn. Soc. Bot. Vol. 6 p. 168 (sec. spec.); Tilden Amer. Alg. No. 316; *P. californica* Setch. et Gardn. Alg. Northwest. Amer. p. 327; Collins, Holden and Setchell P. B. A. No. 1142; non Harv. in Journ. Linn. Soc. Bot. Vol. 6 p. 168. — Type specimens from Hermite Island, Cape Horn.

San Juan Island, near the new marine station; on stones below middle low water mark; with cystocarps and tetraspores.

The specimens which I refer to *P. tenuistriata* are identical with specimens of *P. atrorubescens* Harv. (l. c.), which I have seen in J. Agardh's herbarium. Collins says (1913 p. 120) that authentic material of *P. tenuistriata* agrees well with *P. atrorubescens* Harv. from Vancouver Island and because of this fact he has named the latter plant *P. tenuistriata.* I myself have not seen any authentic material of this species.

Pterosiphonia Falkenb. (1889).

1) Branches round or only slightly compressed; side branches in an interspace of 2—3 (sometimes 4) articulations.
   a) Plant 6—12 cm high; articulations in the main branches 4—8 times as long as broad.
      *) Articulations with about 11—13 pericentral cells; lower branchlets often curved backwards ..... *Pt. bipinnata.*
      **) Articulations with 6—7 pericentral cells ..... *Pt. arctica.*
   b) Plant 2—4 cm high; articulations in the main branches about as long as broad. *Pt. gracilis.*

2) Branches very conspicuously compressed.

a) Plant 6—12 cm high; side branches in an interspace of 4—6 articulations. *Pt. Woodii.*

b) Plant 4—6 cm high; side branches constantly in an interspace of 2 articulations. *Pt. dendroidea.*

Pterosiphonia Woodii (Harv.) Falkenb. Rhodomel. p. 274; *Polysiphonia Woodii* Harv. (1853) Ner. Bor. Amer. 2 p. 52. — Type specimens from California.

West coast of Whidbey Island (Setchell and Gardner 1903 p. 329).

Pterosiphonia bipinnata (Post. et Rupr.) Falkenb. Rhodomel. p. 273; *Polysiphonia bipinnata* Post. et Rupr. (1840) Illustr. Alg. p. 22; *P. californica* Harv. Ner. Bor. Amer. p. 48(?); Harv. in Journ. Linn. Soc. Bot. Vol. 6 p. 168 (sec. specim.); non Setch. et Gardn. Alg. Northwest. Amer. p. 327; *P. nigrescens* Tilden Amer. Alg. No. 318. — Type specimens from Kamtshatka.

San Juan Island, Brown Island, Turn Rock; common in the litoral and upper sublitoral zones; with tetrasporangia.

Pterosiphonia arctica Setch. et Gardn. (1903) Alg. Northwest. Amer. p. 329 pl. 19. — Type specimens from Alaska and Whidbey Island, Wash.

West coast of Whidbey Island (Setchell and Gardner 1903 p. 329); San Juan Island and Shaw Island (Muenscher 1915 p. 78 and 1916 p. 208).

Setchell and Gardner have identified a *Pterosiphonia* species from the west coast of North America with *Polysiphonia arctica* J. Ag. It has, however, already been pointed out by Rosenvinge (1910 p. 107) that the latter species is a true *Polysiphonia* and not a *Pterosiphonia*. In the herbarium of the Marine Station at Friday Harbor I have seen a specimen, collected at Friday Harbor in 1904, and labelled *Pterosiphonia arctica*. The specimen in question represents a true *Pterosiphonia* species.

Pterosiphonia dendroidea (Mont.) Falkenb. Rhodomel. p. 268; *Polysiphonia dendroidea* Mont. (1837) in Ann. Sc. Nat. Bot. S. 2 T. 8 p. 353, and in Voyage au Pole Sud p. 16 pl. 5; Kütz. Tab. Phyc. 13 pl. 25. — Type specimens from the coast of Peru.

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, Peavine Pass, dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Pterosiphonia gracilis Kylin nov. sp.

Frond 2—4 cm high, distichously branched; branchlets distichously pinnate; branches and branchlets round or slightly compressed not corticate; side branches in an interspace of 2—3 articulations, conjuncted with the main branch along one articulation; articulations of the main branches 200—300 μ broad, 1—1,5 times as long as broad; number of pericentral cell 8; cystocarps shortly pedicellate, lateral on the branchlets; tetrasporangia in one row in the ultimate branchlets[1].

[1] *Pterosiphonia gracilis* Kylin nov. sp. — Frons 2—4 cm alta, alterne distiche ramosa; ramuli distiche pinnati; rami ramulique teretes vel leviter complanati, ecorticati; ramuli 2—3 articulis distantes, basi articulo proximo rami adnati; articuli ramorum 200—300 μ crassi, diametrum

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, Shaw Island, dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

Collins (1913 p. 121) says that *Pterosiphonia parasitica* is represented at Vancouver Island by two forms: forma *borealis* n. f., more slender and less branched than the European type; forma *luxurians* n. f., broader, several times pinnate. The typical form is intermediate and has not been reported from Vancouver Island. — I have not seen any of Collin's specimens but I suppose that *f. borealis* is identical

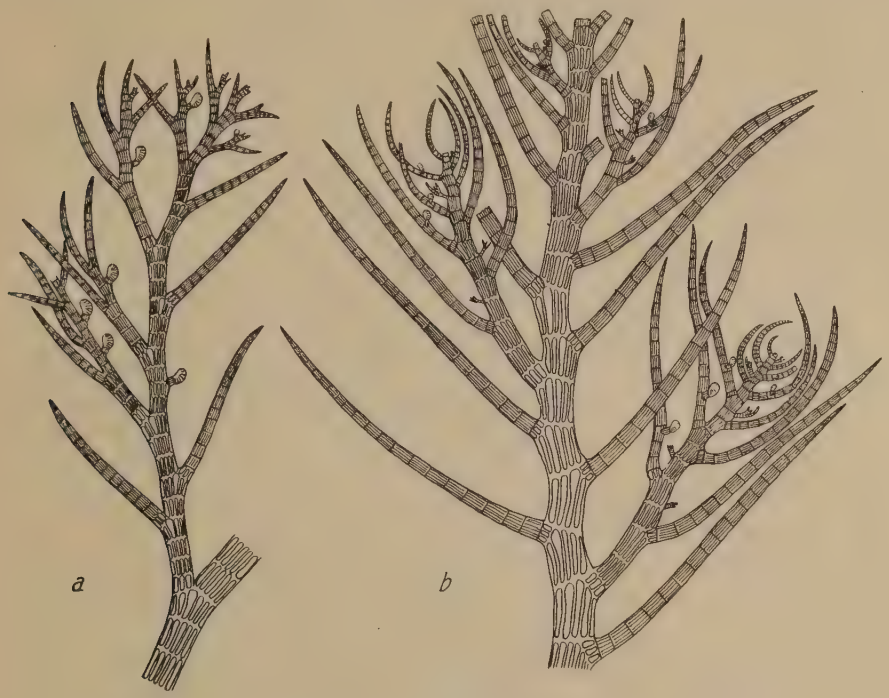

Fig. 47. *a Pterosiphonia gracilis; b Herposiphonia grandis* — × 25.

with the new-described species, *Pt. gracilis*, and *f. luxurians* with *Pt. dendroidea*. In my opinion *Pt. dendroidea* is a distinct species and can not be considered as a form of *Pt. parasitica;* also the new-described *Pt. gracilis* represents a distinct species. The latter one is rather like small and slender forms of *Pt. parasitica*, but in this one there are constantly an interspace of two articulations between the side branches, while in *Pt. gracilis* the interspaces vary from two to three articulations. — My specimens of *Pt. gracilis* are very variable as to the abundance of the side branches on the branchlets. The female specimens are more richly branched than the tetrasporic ones.

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aequantes vel eo sesquilongiores; celluli pericentrales 8; cystocarpia breviter pedicellata, ramulis lateraliter insidentia; tetrasporangia in pinnulis una serie disposita.

Herposiphonia Naeg. (1846).

Herposiphonia grandis Kylin nov. sp.; *Pterosiphonia dendroidea* Collins, Holden and Setchell P. B. A. No. 1146; *Pt. plumula* Collins, Holden and Setchell P. B. A. No. 1798.

Frond 4—6 cm high, distichously branched; side branches of two kinds, viz. small, simple branchlets, and repeatedly branched, long branches; the former alternate and 2—3 mm long, the latter alternate, and repeating the ramification of the mother branch; between the long branches are always three small branchlets; articulations 1—1,5 times as long as broad, not corticate, provided with 8 pericentral cells; main branches in the lower part of the frond up to 200 μ thick; cystocarps shortly pedicellate, one, seldom two, on the lower part of the branchlets; tetrasporangia seriate in the branchlets [1].

San Juan Island, on the piles of Friday Harbor's docks; Canoe Island, Peavine Pass, dredged at a depth of 5—10 fathoms; with cystocarps and tetraspores.

J. Agardh (1884 p. 99) has described a plant from the Californian coast (Santa Barbara) under the name of *Polysiphonia plumula*. Later on the plant has been referred to the genus *Herposiphonia* (Falkenberg 1901 p. 317). The type specimen in J. Agardh's herbarium represents a species related to the new-described *H. grandis*, but is quite distinct from this. The erect branches of J. Agardh's specimen are 2—3 cm high, the branchlets about 1 mm in length, the articulations 0,5(—1) times as long as broad, the main branches up to 400 μ thick; the plant grows on a *Corallina sp.*

Distributed as No. 640 in Phycoth. Bor. Amer. there is a plant named *Polysiphonia verticillata* Harv. I cannot see any essential difference between this plant and *P. plumula* J. Ag. In Farlow, Andersson and Eaton Algae Exsic. Am. Bor. there is a plant, distributed as No. 53 and also named *Polysiphonia verticillata* Harv. This, too, seems to be identical with *P. plumula* J. Ag. — *Polysiphonia verticillata* is described by Harvey in 1841 (p. 165). I have not seen any type specimen, if, however, the above-mentioned plants distributed as No. 640 and No. 53 are correctly referred, the species in question ought to be named *Herposiphonia verticillata* (Harv.) Kylin; Syn. *Polysiphonia plumula* J. Ag.

It may further be mentioned that I have not seen other hairs in *H. grandis* than those which are supporting procarps. These hairs generally grow out from the fourth or fifth articulations of the unbranched branchlets or from both of them.

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[1] *Herposiphonia grandis* Kylin nov. sp. — Frons 4—6 cm alta, dichotome ramosa; rami biformes, aut simplices alternantes, 2—3 mm longi, aut compositi alternantes, articulis quaternis distantes; articuli ecorticati, diametrum aequantes vel eo sesquilongiores, 8 cellulis pericentralibus ornati; rami principales in inferiore parte frondis usque ad 200 μ crassi; cystocarpia brevissime pedicellata singula nonnumquam bina inferiori parte pinnularum insidentia; tetrasporangia in pinnulis singula serie disposita.

Lophosiphonia Falkenb. (1897).

Lophosiphonia obscura (Ag.) Falkenb. Rhodomel. p. 500; *Hutchinsia obscura* Ag. (1828) Spec. Alg. 2 p. 108; *Polysiphonia atrorubescens f. psammicola* Tilden Amer. Alg. No. 317 (see Setchell and Gardner 1903 p. 329). — Type specimens from the European coasts of the Atlantic Sea.

San Juan Island (Setchell and Gardner l. c. p. 329).

Rhodomela Ag. (1822).

Rhodomela larix (Turn.) Ag. Spec. Alg. 376; Tilden Amer. Alg. No. 209; *Fucus larix* Turn. (1819) Hist. Fuc. Vol. 4 p. 23 pl. 207. — Type specimens from Nootka Sound, B. C.

Common on rocks in the litoral zone; with cystocarps and tetraspores.

Odonthalia Lyngb. (1819).

1) Branches compressed, but not flat; cystocarps and tetraspores on the branchlets in the younger parts of the frond ..... *O. floccosa.*
2) Branches in the lower part of the frond compressed, in the upper part flat, without well-marked midribs; cystocarps and tetraspores in dense glomerules on the mature parts of the frond ..... *O. washingtoniensis.*
3) Branches in the lowest part of the frond compressed stem-like, in the middle part flat with well-marked midribs, in the uppermost parts flat generally without midribs; cystocarps and tetraspores scattered on the branchlets in the younger parts of the frond ..... *O. kamtschatica.*
4) Branches throughout flat, without midribs ..... *O. Lyallii.*

Odonthalia floccosa (Esper) Falkenb. Rhodomel p. 607; *Fucus floccosus* Esper (1802) Icon. Fuc. 2 p. 42 pl. 130; Turn. Hist. Fuc. Vol. 1 pl. 8; *Rhodomela floccosa* Post. et Rupr. Illustr. Alg. pl. 38; Tilden Amer. Alg. No. 313, 314, 315; *Odonthalia aleutica* Collins, Holden and Setchell P. B. A. No. 1147. — Type specimens from Port Trinidad, Calif. (see Turner l. c.)

San Juan Island, south of False Bay; Brown Island; on rocks in the litoral zone; with cystocarps and tetraspores.

There has been much trouble concerning the differences between *Odonthalia floccosa* and *O. aleutica* (C. Ag.) J. Ag., mainly due to a figure in C. Agardh Icon. Alg. pl. 5, which is the type drawing of *O. aleutica,* but very much alike *O. floccosa.* I have examined the type specimens of *O. aleutica,* and due to this examination I can assert that *O. floccosa* and *O. aleutica* represent two quite different species, and further that the plant, referred by Setchell and Gardner (1903 p. 333) and by Collins (1913 p. 122) to *O. aleutica,* represents the same species (may be a different form) as the specimens, referred by these authors to *O. floccosa* (see below).

Most of my specimens from the district south of False Bay (from exposed rocks) come very near *f. macrantha* (Kütz.) Setch. et Gardn. (l. c. p. 335), some other come near *f. comosa* Setch. et Gardn. (l. c. p. 334). The specimens from Brown Island (from not exposed rocks) are smaller and more slender than the two first-mentioned forms and represent a *f. tenuis* Kylin mscr. This form is distributed as No. 313 in Tilden Amer. Alg. and by Setchell and Gardner (l. c. p. 333) considered to be the typical form of *O. floccosa;* as to my opinion the *f. macrantha* is a more typical form of the species in question.

Odonthalia washingtoniensis Kylin nov. sp.; *O. semicostata* Setch. et Gardn. Alg. Northwest. Amer. p. 336 pl. 26—27; Collins, Holden and Setchell P. B. A. No. 941; *O. dentata* Tilden Amer. Alg. No. 312.

Frond up to 20 cm high, coarse and cartilaginous, richly distichously branched branches in the lower part of the frond slightly compressed, in the upper part flat, in all parts without well-marked midribs; branchlets subulate; cystocarps and tetraspores in dense glomerules on the mature parts of the frond [1].

San Juan Island, near Cattle Point; on rocks in the upper sublitoral zone. I have not collected any fruiting specimens; according to Setchell and Gardner (l. c.) such ones are to be found in the month of August.

Odonthalia kamtschatica (Rupr.) J. Ag. Spec. Alg. 2 p. 896. *Atomaria kamtschatica* Rupr. (1850) Alg. Ochot. p. 214; *Odonthalia augustifolia* Post. et Rupr. (1840) Illustr. Alg. pl. 27; non(?) Suhr in Flora 1839 p. 71 pl. 45 — Type specimens from Kamtshatka.

San Juan Island, south of False Bay; on stones and rocks at the lowest low-water mark; with tetraspores.

In J. Agardh's herbarium I have seen the type specimens of *Odonthalia kamtschatica* and *O. setacea* (Ruprecht 1850 p. 214—215; both referred to the genus *Atomaria*). The two species are nearly related to each other, and I can hardly see any essential difference between them. *Odonthalia aleutica* (C. Ag.) also belongs to this group of species, and is by J. Agardh considered to represent the same species as *O. setacea*. The type specimens show that these two species are very much alike. The type specimen of *Odonthalia semicostata* J. Ag. (1863 p. 898; *Fucus semicostatus* Mert. mscr.) shows that this species also belongs to the above-mentioned group of species.

Odonthalia Lyallii (Harv.) J. Ag. Spec. Alg. 2 p. 894; *Rhodomela Lyallii* Harv. (1862) in Journ. Linn. Soc. Bot. Vol. 6 p. 168; *Laurencia Grevilleana* Tilden Amer. Alg. No. 319; *Odonthalia Lyallii* Collins, Holden and Setchell P. B. A. No. 940. — Type specimens from Fuca Strait, Wash.

Turn Island; dredged at a depth of 5—10 fathoms; with cystocarps.

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[1] *Odonthalia washingtoniensis* Kylin nov. sp. — Frons usque ad 20 cm alta, robusta, cartilaginea, distiche ramosissima; rami in inferiori parte frondis subtereti vel leviter compressi, in superiore parte complanati, omnes ecostati; ramuli subulati; cystocarpia et tetrasporangia glomerulos densos in matura parte frondis formantia.

Laurencia Lamour. (1813).

Laurencia spectabilis Post. et Rupr. (1840) Illustr. Alg. p. 16; *L. californica* Kütz. Tab. Phyc. 15 pl. 67; *L. pinnatifida* Setch. et Gardn. Alg. Northwest. Amer. p. 326. — Type specimens from Norfolk Sound, near Sitka, Alaska.

San Juan Island, south of False Bay; on rocks in the lower litoral and upper sublitoral zones; with cystocarps and tetraspores.

This species has generally been identified with the European *L. pinnatifida;* it is, however, much coarser and provided with broader branches than the European one, and represents, as to my opinion, a good species.

Janczewskia Solms-Laub. (1877).

Janczewskia Gardneri Setch. et Guernsey (1914) in Univ. Calif. Publ. Bot. Vol. 6 p. 12; J. *verrucaeformis* Setch. et Gardn. Alg. Northwest. Amer. p. 326. — Type specimens from Whidbey Island, Wash.

West coast of Whidbey Island, growing on *Laurencia spectabilis* (Setchell and Gardner l. c.)

Key to the genera.

I. Frond calcareous.

A) Branched.

1) Branches in one plane, internodes usually as long as broad ... *Amphiroa.*

2) Branches in more than one plane; intermodes usually more long than broad *Corallina.*

B) Unbranched, crustaceous, growing on stones, shells or other algae *Lithothamnion.*

II. Frond not calcareous.

A) Frond like a cluster, growing parasitic on other red algae.

1) Growing on Callophyllis ..... *Callocolax* (p. 35).

2) Growing on Hymenena and Cryptopleura ..... *Gonimophyllum* (p. 68).

3) Growing on Laurencia ..... *Janczewskia* (p. 77).

B) Frond crustaceous, growing on stones, shells or other algae.

1) Frond microscopic, about 70—90 μ in diameter, consisting of one layer of cells ..... *Erythrocladia* (p. 9).

2) Frond macroscopic, consisting of many layers of cells.

a) Not filamentous, consisting of cells closely connected to each other.

*) Spores in tiny cavities ..... *Hildenbrandtia* (p. 27).

**) Spores in nemathecia on the surface of the frond *Peyssonnelia* (p. 25).

b) Frond mainly consisting of erect filaments; tetraspores in the erect filaments ..... *Petrocelis* (p. 24).

C) Frond very much inflate, sac-like.

1) Frond up to 10 cm high; generally unbranched; reddish brown; no cystocarps ..... *Halosaccion* (p. 43).

2) Frond up to 5 cm high; generally branched; red; cystocarps present. *Chrysymenia* (p. 42).

D) Frond consisting of roundish, unbranched filaments.

1) About 2—4 mm long; in mature stage with 1—4(—8) rows of cells. *Erythrotrichia* (p. 8).

2) Up to 10 cm long; in mature stage with many rows of cells *Bangia* (p. 6).

E) Frond erect, branched; branches cylindrical or sometimes a little compressed.

1) Frond less than 5(—10) mm high.

a) Cellwalls very thick; most of the vegetative cells can be transformed into monospores ..... *Goniotrichum* (p. 6).

b) Cellwalls thin; monospores or tetraspores in well marked sporangia.

*) Sporangia with monospores ..... *Acrochaetium* (p. 10).

**) Sporangia with tetraspores ..... *Rhodochorton* (p. 44).

2) Frond more than (5—)10 mm high.
a) All branches consisting of only one row of cells.
*) Cells in the main branches with two opposite, or 3—4 verticillate branchlets.
α) No essential difference between the side branchlets.
Antithamnion (p. 45).
β) Four verticillate side branchlets, two large and two small ones.
Platythamnion (p. 51).
**) Side branchlets not (or at least very seldom) opposite.
α) Not very richly, dichotomously, branched, cells very large.
Griffithsia (p. 58).
β) Very richly, not dichotomously branched, no hyaline glandular cells.
†) Sporangia with 4 spores; procarps and cystocarps lateral.
Callithamnion (p. 54).
††) Sporangia with many (generally 16) spores; procarps and cystocarps subterminal ..... *Pleonosporium* (p. 56).
γ) Frond sparsely and irregularly branched; each cell with a small, hyaline glandular cell ... . *Trailliella* (p. 44).
b) Branches consisting of a central row of large cells, each cell with a whorl of about 6 irregularly, richly branched branchlets... *Thuretellopsis* (p. 13).
c) Branches polysiphonous.
*) Branches in all directions.
α) Frond erect, richly branched ..... *Polysiphonia* (p. 71).
β) Erect filaments sparsely branched; most of the filaments creeping on sand-covered rocks ..... *Lophosiphonia* (p. 75).
**) Branches in one plane.
α) Terminal branches consisting of one row of cells *Heterosiphonia* (p. 70).
β) All branches consisting of more than one row of cells.
†) Branches and branchlets regularly alternating, frond sometimes distinctly flat..... *Pterosiphonia* (p. 71).
††) Always three simple side branchlets between two side branches.
Herposiphonia (p. 74).
d) Branches in cross section consisting of many cells, but not polysiphonous.
*) Branches ending in crab-like claws.
α) Light and dark bands alternating on the branches, due to differences in the cortication ..... *Ceramium* (p. 61).
β) No light and dark bands; all the branches throughout densely corticated. ..... *Microcladia* (p. 63).
**) Ultimate branches hair-like, arranged like a feather; frond up to 15—25 cm high ..... *Dasyopsis* (p. 68).
***) Frond dichotomously branched, ultimate branches thick, not hair-like, not like crab-claws.

α) Frond about 3—4 cm high, growing above low-tide *Gloiopeltis* (p. 16).
β) Frond about 8—10 cm high, growing in deep water *Gloiophloea* (p. 12).
****) Frond moss-like, richly and very irregularly branched with many spine-like projections; growing at high-water mark ..... *Endocladia* (p. 28).
*****) Branches thin and gelatinous, once pinnately compound; many hyaline glandular cells on the surface ..... *Asparagopsis* (p. 13).
******) Frond and branches otherwise.
α) Medullary layer consisting of long intertwined filaments; branches not compressed.
†) Frond reddish brown, densely, irregularly branched, not gelatinous; at least the ultimate branches short ..... *Cryptosiphonia* (p. 14).
††) Frond red, verticillately or sparsely alternately branched, gelatinous. *Gloiosiphonia* (p. 16).
†††) Frond red, somewhat cartilaginous; branches long, not very dense. *Agardhiella* (p. 36).
β) Medullary layer without long, intertwined filaments; branches not compressed; plants more or less cartilaginous.
†) Central cells in the cross section very large, peripheric ones very small ..... *Gracilaria* (p. 39).
††) No great difference between the central and peripheric cells in the cross section ..... *Ahnfeltia* (p. 30).
†††) One distinct central cell in the cross section; branches in very dense groups on a distinct main branch ..... *Rhodomela* (p. 75).
γ) Frond somewhat compressed, with branches from the edges; plants more or less cartilaginous.
†) Plant reddish brown ..... *Odonthalia* (p. 75).
††) Plant red to violet... ..... *Gelidium* (p. 12).
δ) Frond not compressed; ultimate branches hollow *Chylocladia* (p. 42).
G) Frond erect, distinctly compressed, generally flat, usually broad, often blade-like.
1) Frond with veins (sometimes only microscopic ones).
a) Distinct central vein up to the apex.
*) Vein interrupted ..... *Stenogramma* (p. 30).
**) Vein not interrupted.
α) Branching from the midrib ..... *Delesseria* (p. 64).
β) Branching from the edge of the frond.
†) Edge dentate and ciliate ..... *Heteronema* (p. 64).
††) Edge not dentate and not ciliate ..... *Membranoptera* (p. 63).
b) No distinct central vein in the upper part of the frond.
*) Veins prominent and anastomosing ..... *Polyneura* (p. 64).
**) Veins more or less parallel; sometimes only microscopic.

α) Frond without ruffled edge; tetraspores in many parallel lines, or in more or less long sori scattered over the surface *Hymenena* (p. 66).

β) Frond with ruffled edge; tetraspores along the edge or in the ruffles ..... *Cryptopleura* (p. 67).

***) Central vein without side nerves; no microscopic veins. *Odonthalia* (p. 75).

2) Frond without veins.

a) Frond with a peltate blade on a distinct stem; rose-like. *Constantinea* (p. 16).

b) Frond with round, blade-like prolifications from the edge of the frond; the blades are like the mother frond ..... *Opuntiella* (p. 23).

c) Frond feather-like; branches narrow, compressed, repeatedly pinnately compound ..... *Ptilota* (p. 60).

d) Frond richly branched; branches narrow, flat; young branches repeatedly pectinate ..... *Plocamium* (p. 42).

e) Frond otherwise; papillated ..... *Gigartina* (p. 29).

f) Frond otherwise; not papillated.

*) Medullary layer consisting of long intertwined filaments.

α) Frond large, blade-like, orbicular, reniform, or broadly lanceolate, unbranched, but sometimes more or less laciniate.

†) Cortical layer with hyaline glandular cells... *Turnerella* (p. 21).

††) Cortical layer without glandular cells.

o) Gonimoblasts immersed in the frond without any special enveloping filaments.

aa) Tetraspores in sori.

αα) Sori in the medullary layer covered with cortical cells ..... *Iridaea* (p. 28).

ββ) Sori in the cortical layer, not covered with cells. *Rhodoglossum* (p. 28).

bb) Tetraspores scattered in the cortical layer, not in sori.

αα) Gonimoblasts consisting of many lobes; no special auxiliary cell branches ..... *Callymenia* (p. 35).

ββ) Gonimoblasts not lobed; special auxiliary cell branches present ..... *Weeksia* (p. 15).

oo) Gonimoblasts immersed in the frond, provided with special enveloping filaments.

aa) Frond thick, cortical layer consisting of many rows of cells..... *Aeodes* (p. 17).

bb) Frond thick, cortical layer consisting of one row of cells ..... *Whidbeyella* (p. 12).

cc) Frond thin (60—70 μ), cortical layer consisting of 1—2 rows of cells ..... *Cryptonemia* (p. 19).

β) Frond lanceolate or ribbon-like, more or less branched from the edge; many top cells in the growing point.

†) Frond gelatinous ..... *Grateloupia* (p. 18).

††) Frond cartilaginous ..... *Prionitis* (p. 19).

γ) Frond gelatinous, below ribbon-like, branched from the edge, above more or less string-like, irregularly branched, a special top cell in the growing point ..... *Farlowia* (p. 15).

δ) Frond with a few, broad, dichotomous branches *Anatheca* (p. 36).

**) Medullary layer of the frond consisting of big and small cells mixed together; many long and thin filaments between the carpospores in the gonimoblast.

α) Frond irregularly orbicular, thin and easily torn *Pugetia* (p. 30).

β) Frond more or less dichotomously branched... *Callophyllis* (p. 31).

***) Medullary layer of the frond consisting of big cells only, cortical layer of small ones.

α) Frond richly branched; the flat branches about 1 mm broad, edge not dentate ..... *Euthora* (p. 39).

β) Frond broad, blade-like, undivided, laciniate or more or less dichotomously branched.

†) Tetraspores in small, round spots on the frond *Stenogramma* (p. 30).

††) Tetraspores scattered or in irregular stripes, almost covering the whole surface of the frond.

o) One row of small assimilating cells on the surface of the frond ..... *Rhodymenia* (p. 39).

oo) Three to four rows of small assimilating cells on the surface of the frond ..... *Fauchea* (p. 39).

γ) Frond richly branched, the flat branches 2—6(—10) mm broad, edge dentate ..... *Odonthalia* (p. 75).

δ) Frond dichotomously branched, cartilaginous; branches 3—5 mm broad; in the lower part of the frond compressed, in the upper one flat; tips generally spatulate ..... *Laurencia* (p. 77).

****) No distinguishable medullary or cortical layer.

α) Frond orbicular, less than 5 mm in diameter *Porphyropsis* (p. 9).

β) Frond irregularly orbicular or lanceolate, large.

†) The fertile cells producing either many colourless spermatia or 4—8—16 carpospores; no cystocarps ..... *Porphyra* (p. 6).

††) Cystocarps present; tetraspores in sori; both scattered over the frond ..... *Nitophyllum* (p. 64).

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